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NFPA® 10

Standard for Portable Fire Extinguishers

2010 Edition

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NFPA® 10

Standard for

Portable Fire Extinguishers

2010 Edition

This edition of NFPA 10, *Standard for Portable Fire Extinguishers*, was prepared by the Technical Committee on Portable Fire Extinguishers. It was issued by the Standards Council on October 27, 2009, with an effective date of December 5, 2009, and supersedes all previous editions.

This edition of NFPA 10 was approved as an American National Standard on December 5, 2009.

Origin and Development of NFPA 10

In 1918 and 1919, the NFPA Committee on Field Practice (predecessor of the present committee) was active in developing a standard on first aid protection. The earliest official NFPA standard on this subject was adopted in 1921. Revised editions were adopted by the Association in 1926, 1928, 1929, 1930, 1931, 1932, 1936, 1938, 1942, 1945, 1950, 1953, 1955, 1956, 1957, 1958, 1959, 1961, 1962, 1963, 1965, 1966, 1967, 1968, 1969, 1970, 1972, 1973, 1974, 1975, 1978, and 1981. In 1965, the previous editions were divided into two separate texts, one covering installation and the second covering maintenance and use. The 1974 edition recombined all the information previously contained in NFPA 10 and NFPA 10A. A new appendix was added to the 1974 edition to include information about the selection of fire extinguishers for home hazards. Information on selection and distribution of fire extinguishers was added to the appendix of the 1978 edition. Major revisions to provide simplification and uniformity were made in the 1984 edition. The standard was revised in 1988, 1990, and 1994.

In 1998,NFPA 10R, *Recommended Practice for Portable Fire Extinguishing Equipment in Family Dwelling Units and Living Units,* was withdrawn. Information on this topic was incorporated as an annex of NFPA 10.

This standard was revised in 2002.

The 2007 edition of this standard was a complete revision.

The 2010 edition of this standard includes changes to comply with the *Manual of Style for NFPA Technical Committee Documents* by removing unenforceable terms. Annex material was also added to clarify the need for removing obsolete extinguishers.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the installation, maintenance, and use of portable fire extinguishers and equipment. Does not apply to permanently installed fire extinguishing systems even though portions of those systems are portable, such as hose and nozzles, which may be attached to a fixed supply of extinguishing agent.

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NFPA 10

Standard for

Portable Fire Extinguishers

2010 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (•) between the paragraphs that remain.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2 and those for extracts in informational sections are given in Annex K. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced publications can be found in Chapter 2 and Annex K.

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Chapter 1 Administration

1.1* Scope. The provisions of this standard apply to the selection, installation, inspection, maintenance, and testing of portable extinguishing equipment.

1.1.1 Portable fire extinguishers are intended as a first line of defense to cope with fires of limited size.

1.1.2 The selection and installation of extinguishers is independent of whether the building is equipped with automatic sprinklers, standpipe and hose, or other fixed protection equipment. *(See 5.5.5, 6.1.1.1, 6.2.1.1, and 6.2.1.5.)*

1.1.3 The requirements given herein are minimum.

1.1.4 The requirements do not apply to permanently installed systems for fire extinguishment, even where portions of such systems are portable (such as hose and nozzles attached to a fixed supply of extinguishing agent).

1.2* Purpose. This standard is prepared for use by and guidance of persons charged with selecting, purchasing, installing, approving, listing, designing, and maintaining portable fire-extinguishing equipment.

1.2.1 The fire protection requirements of this standard are general in nature and are not intended to abrogate the specific requirements of other NFPA standards for specific occupancies.

1.2.2 Nothing in this standard shall be construed as a restriction on new technologies or alternative arrangements, provided that the level of protection as herein described is not lowered and is acceptable to the authority having jurisdiction.

1.3 Units.

1.3.1 Metric units of measurement in this standard are in accordance with the modernized metric system known as the International System of Units (SI).

1.3.1.1 The units are listed in Table 1.3.1.1 with conversion factors.

Table 1.3.1.1 Metric Units of Measurement

Name of Unit	Abbreviation	Conversion Factor
Liter	L	1 gal = 3.785 L
Millimeter	mm	1 in. = 25.4 mm
Meter	m	1 ft = 0.305 m
Kilogram	kg	1 lb (mass) = 0.454 kg
Degree Celsius	°C	5⁄9(°F – 32) = °C
Bar	bar	1 psi = 0.0689 bar

1.3.1.2 If a value for measurement as given in this standard is followed by an equivalent value in other units, the first stated is to be regarded as the requirement.

1.3.1.3 A given equivalent value shall be permitted to be considered approximate.

1.3.2 The conversion procedure for the SI units is to multiply the quantity by the conversion factor and then round the result to the appropriate number of significant digits.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* 2010 edition.

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages,* 2008 edition.

NFPA 32, *Standard for Drycleaning Plants,* 2007 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2008 edition.

NFPA 72®, *National Fire Alarm and Signaling Code,* 2010 edition.

NFPA 86, *Standard for Ovens and Furnaces,* 2007 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations,* 2008 edition.

NFPA 120, *Standard for Fire Prevention and Control in Coal Mines,* 2010 edition.

NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities,* 2010 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations,* 2009 edition.

NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft,* 2010 edition.
NFPA 303, *Fire Protection Standard for Marinas and Boatyards,* 2006 edition.
NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids,* 2007 edition.
NFPA 400, *Hazardous Materials Code,* 2010 edition.
NFPA 407, *Standard for Aircraft Fuel Servicing,* 2007 edition.
NFPA 408, *Standard for Aircraft Hand Portable Fire Extinguishers,* 2010 edition.
NFPA 410, *Standard on Aircraft Maintenance,* 2010 edition.
NFPA 418, *Standard for Heliports,* 2006 edition.
NFPA 498, *Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives,* 2010 edition.
NFPA 1192, *Standard on Recreational Vehicles,* 2008 edition.
NFPA 1194, *Standard for Recreational Vehicle Parks and Campgrounds,* 2008 edition.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D 5391, *Standard Test for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample,* 2005.

2.3.2 CGA Publications. Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923.

CGA C-1, *Methods of Hydrostatic Testing of Compressed Gas Cylinders,* 2006.

2.3.3 NPCA Publications. National Paint and Coatings Association, 1500 Rhode Island Avenue, NW, Washington, DC 20005.

Hazardous Materials Identification System (HMIS), Implementational Manual, 1981.

Workplace Hazardous Materials Identification System (WHMIS) Reference Manual, 1996, Revised (Web Edition) 2000.

2.3.4 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 8, *Water Based Agent Fire Extinguishers,* 2005, Revised 2007.

ANSI/UL 154, *Standard for Carbon-Dioxide Fire Extinguishers,* 2005, Revised 2007.

ANSI/UL 299, *Standard for Dry Chemical Fire Extinguishers,* 2002, Revised 2007.

ANSI/UL 626, *Standard for Water Fire Extinguishers,* 2005, Revised 2007.

ANSI/UL 711, *Standard for Rating and Fire Testing of Fire Extinguishers,* 2004, Revised 2007.

UL 1093, *Standard for Halogenated Agent Fire Extinguishers,* 1995, Revised 2008.

UL 1803, *Standard for Factory Follow-Up on Third Party Certified Portable Fire Extinguishers,* 2006, Revised 2008.

ANSI/UL 2129, *Standard for Halocarbon Clean Agent Fire Extinguishers,* 2005, Revised 2007.

2.3.5 ULC Publications. Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, Ontario M1R 3B4, Canada.

CAN/ULC-S503, *Standard for Carbon-Dioxide Fire Extinguishers,* 2005, Revised 2007.

CAN/ULC-S504, *Standard for Dry Chemical Fire Extinguishers,* 2005, Revised 2007.

CAN/ULC-S507, *Standard for Water Fire Extinguishers,* 2005, Revised 2007.

CAN/ULC-S508, *Standard for Rating and Testing of Fire Extinguishers,* 2004, Revised 2007.

CAN/ULC-S512, *Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers,* 2005, Reaffirmed 2007.

CAN/ULC-S554, *Standard for Water Based Agent Fire Extinguishers,* 2005, Revised 2007.

CAN/ULC-S566, *Standard for Halocarbon Clean Agent Fire Extinguishers,* 2005, Revised 2007.

2.3.6 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 49, Code of Federal Regulations, Part 180.209(b), 2007.

Title 49, Code of Federal Regulations, Part 180.213(c)(1), 2007.

2.3.7 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2009 edition.
NFPA 17A, *Standard for Wet Chemical Extinguishing Systems,* 2009 edition.
NFPA 18, *Standard on Wetting Agents,* 2006 edition.
NFPA 52, *Vehicular Gaseous Fuel Systems Code,* 2010 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of

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products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.2.6 Should. Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

3.3 General Definitions.

3.3.1 ANSI. American National Standards Institute. [**52,** 2010]

3.3.2 Antifreeze Charge. See 3.3.20, Loaded Stream Charge.

3.3.3* Carbon Dioxide. A colorless, odorless, electrically nonconductive inert gas that is a suitable medium for extinguishing Class B and Class C fires.

• **3.3.4 Chemical.**

3.3.4.1* ***Dry Chemical.*** A powder composed of very small particles, usually sodium bicarbonate-, potassium bicarbonate-, or ammonium phosphate-based with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking), and the proper flow capabilities. [**17,** 2009]

3.3.4.2* ***Wet Chemical.*** Normally an aqueous solution of organic or inorganic salts or a combination thereof that forms an extinguishing agent. [**17A,** 2009]

3.3.5 Clean Agent. Electrically non-conducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation.

3.3.6 Closed Recovery System.

3.3.6.1 ***Dry Chemical Closed Recovery System.*** A system that is constructed in a manner that does not introduce foreign material into the agent being recovered and has a means of visually inspecting the recovered agent for contaminants.

3.3.6.2 ***Halogenated Closed Recovery System.*** A system that provides for the transfer of halogenated agents between fire extinguishers, supply containers, and recharge and recovery containers so that none of the halogenated agent escapes to the atmosphere. Closed recovery systems for halogenated agents with an ozone depleting potential (ODP) of 0.2 or greater should be listed for use with that agent. The system's supply or recharge and recovery container is capable of maintaining the agent in a sealed environment until it is reused or returned to the agent manufacturer.

3.3.7 Cylinder.

3.3.7.1 ***High-Pressure Cylinder.*** Cylinders (and cartridges) containing nitrogen, compressed air, carbon dioxide, or other gases at a pressure higher than 500 psi (3447 kPa) at 70°F (21°C).

3.3.7.2 ***Low-Pressure Cylinder.*** Cylinders containing fire-extinguishing agent (medium), nitrogen, compressed air, or other compressed gases at a service pressure of 500 psi (3447 kPa) or lower at 70°F (21°C).

3.3.8 DOT. U.S. Department of Transportation. [**52,** 2010]

3.3.9* Dry Powder. Solid materials in powder or granular form designed to extinguish Class D combustible metal fires by crusting, smothering, or heat-transferring means.

3.3.10* Electronic Monitoring. A method of electronic communication (data transmission) between an in-place fire extinguisher and an electronic monitoring device/system.

3.3.11 Extinguisher Bracket. Extinguisher retention device designed to mount and secure a specific extinguisher model onto various surfaces by incorporating releasable straps or bands to secure the fire extinguisher.

3.3.12 Extinguisher Cabinet. An identifiable and readily accessible fire extinguisher housing device designed to store and protect fire equipment.

3.3.13 Extinguisher Hanger. Extinguisher mounting device designed for mounting a specific extinguisher model onto stationary vertical surfaces.

3.3.14* Extinguisher Inspection. A quick check that a fire extinguisher is in its designated place, that it has not been actuated or tampered with, and that there is no obvious physical damage or condition to prevent its operation.

3.3.15* Extinguisher Maintenance. A thorough examination of the fire extinguisher that is intended to give maximum assurance that a fire extinguisher will operate effectively and safely and to determine if physical damage or condition will prevent its operation, if any repair or replacement is necessary, and if hydrostatic testing or internal maintenance is required.

3.3.16* Film-Forming Foam Agents. Aqueous film-forming foam (AFFF) and film-forming fluoroprotein foam (FFFP).

3.3.17 Flammable Liquids of Appreciable Depth. Flammable liquids of appreciable depth are those with a depth greater than ¼ in. (6.3 mm).

3.3.18* Halogenated Agents. Halogenated (clean) agents referenced in this standard are of the following types.

3.3.18.1 ***Halocarbons.*** Halocarbon agents include hydrochlorofluorocarbon (HCFC), hydrofluorocarbon (HFC), perfluorocarbon (PFC), and fluoroiodocarbon (FIC) types of agents.

3.3.18.2 ***Halons.*** Halons include bromochlorodifluoromethane (Halon 1211), bromotrifluoromethane (Halon 1301), and mixtures of Halon 1211 and Halon 1301 (Halon 1211/1301).

3.3.19 Hydrostatic Testing. Pressure testing of the extinguisher to verify its strength against unwanted rupture.

3.3.20* Loaded Stream Charge. A water-based extinguishing medium that uses an alkali metal salt as a freezing point depressant.

3.3.21 Mild Steel Shell. All steel shells other than stainless steel and steel shells used for high-pressure cylinders.

3.3.22 Pressure.

3.3.22.1 ***Extinguisher Service Pressure.*** The normal operating pressure as indicated on the nameplate or cylinder of a fire extinguisher.

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3.3.22.2 ***Factory Test Pressure.*** The pressure shown on the nameplate at which a shell was tested at time of manufacture.

3.3.23 Pressurized Flammable Liquid Fires. Fires resulting from liquids that are forced, pumped, or sprayed.

3.3.24 Recharging. The replacement of the extinguishing agent (also includes the expellant for certain types of fire extinguishers).

3.3.25 Servicing. Performing maintenance, recharging, or hydrostatic testing on a fire extinguisher.

3.3.26 TC. Transport Canada, formerly Canada Transport Commission (CTC), which has jurisdiction over high- and low-pressure cylinders and cartridges in Canada.

3.3.27 Travel Distance. The actual walking distance from any point to the nearest fire extinguisher fulfilling hazard requirements.

3.3.28 Wetting Agent. A concentrate which, when added to water reduces the surface tension and increases its ability to penetrate and spread. [**18,** 2006]

3.4 Fire Extinguisher Definitions.

3.4.1 Cartridge/Cylinder-Operated Fire Extinguisher. A fire extinguisher in which the expellant gas is in a separate container from the agent storage container.

3.4.2* Nonrechargeable (Nonrefillable) Fire Extinguisher. A fire extinguisher not capable of (nor intended to be capable of) undergoing complete maintenance and hydrostatic testing and being restored to its full operating capability by the standard procedures used by fire equipment dealers and distributors.

3.4.3 Portable Fire Extinguisher. A portable device, carried or on wheels and operated by hand, containing an extinguishing agent that can be expelled under pressure for the purpose of suppressing or extinguishing fire.

3.4.4* Rechargeable (Refillable) Fire Extinguisher. A fire extinguisher capable of undergoing complete maintenance, including internal inspection of the pressure vessel, replacement of all substandard parts and seals, and hydrostatic testing.

3.4.5 Self-Expelling Fire Extinguisher. A fire extinguisher in which the agents have sufficient vapor pressure at normal operating temperatures to expel themselves.

3.4.6 Stored-Pressure Fire Extinguisher. A fire extinguisher in which both the extinguishing material and expellant gas are kept in a single container, and that includes a pressure indicator or gauge.

3.4.7 Water Mist Fire Extinguisher. A fire extinguisher containing distilled or de-ionized water and employing a nozzle that discharges the agent in a fine spray.

3.4.8 Water-Type Fire Extinguisher. A fire extinguisher containing water-based agents, such as water, AFFF, FFFP, antifreeze, loaded stream, and wet chemical.

3.4.9 Wheeled Fire Extinguisher. A portable fire extinguisher equipped with a carriage and wheels intended to be transported to the fire by one person. *(See A.5.3.2.7.)*

Chapter 4 General Requirements

4.1 Listing and Labeling.

4.1.1 Portable fire extinguishers used to comply with this standard shall be listed and labeled and shall meet or exceed all the requirements of one of the following fire test standards and one of the following applicable performance standards:

(1) Fire test standards
    (a) ANSI/UL 711, *Standard for Rating and Fire Testing of Fire Extinguishers*
    (b) CAN/ULC-S508, *Standard for Rating and Testing of Fire Extinguishers*
(2) Performance standards
    (a) Carbon dioxide types: ANSI/UL 154, *Standard for Carbon-Dioxide Fire Extinguishers*; CAN/ULC-S503, *Standard for Carbon-Dioxide Fire Extinguishers*
    (b) Dry chemical types: ANSI/UL 299, *Standard for Dry Chemical Fire Extinguishers*; CAN/ULC-S504, *Standard for Dry Chemical Fire Extinguishers*
    (c) Water types: ANSI/UL 626, *Standard for Water Fire Extinguishers*; CAN/ULC-S507, *Standard for Water Fire Extinguishers*
    (d) Halon types: UL 1093, *Standard for Halogenated Agent Fire Extinguishers*; CAN/ULC-S512, *Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers*
    (e) Film-forming foam types: ANSI/UL 8, *Water Based Agent Fire Extinguishers*; CAN/ULC-S554, *Standard for Water Based Agent Fire Extinguishers*
    (f) Halocarbon types: ANSI/UL 2129, *Standard for Halocarbon Clean Agent Fire Extinguishers*; CAN/ULC-S566, *Standard for Halocarbon Clean Agent Fire Extinguishers*

4.1.2* The identification of the listing and labeling organization, the fire test standard, and the performance standard that the fire extinguisher meets or exceeds shall be clearly marked on each fire extinguisher.

4.1.2.1 Fire extinguishers manufactured prior to January 1, 1986, shall not be required to comply with 4.1.2.

4.1.3* An organization listing fire extinguishers used to comply with the requirements of this standard shall utilize a third-party certification program for portable fire extinguishers that meets or exceeds UL 1803, *Standard for Factory Follow-Up on Third Party Certified Portable Fire Extinguishers.*

4.1.3.1 Fire extinguishers manufactured prior to January 1, 1989, shall not be required to comply with 4.1.3.

4.1.3.2 Certification organizations accredited by the Standards Council of Canada shall not be required to comply with 4.1.3.

4.1.4 Electrical Conductivity. Extinguishers listed for the Class C rating shall not contain an agent that is a conductor of electricity.

4.1.4.1 In addition to successfully meeting the requirements of ANSI/UL 711, *Standard for Rating and Fire Testing of Fire Extinguishers*, water-based agents shall be tested in accordance with ASTM D 5391, *Standard Test for Electrical Conductivity and Resistivity of a Flowing High Purity Water Sample.*

4.1.4.2 Fire extinguishers containing water-based agents that have a conductivity higher than 1.00 µS/cm at 25°C (77°F) shall be considered a conductor of electricity and therefore shall not be rated Class C.

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4.1.4.3 Subsections 4.1.4.1 and 4.1.4.2 shall apply only to water-based extinguishers manufactured after August 15, 2002.

4.2* Identification of Contents. A fire extinguisher shall have a label, tag, or stencil attached to it providing the following information:

(1) The content's product name as it appears on the manufacturer's Material Safety Data Sheet (MSDS)
(2) Listing of the hazardous material identification in accordance with *Hazardous Materials Identification System (HMIS), Implementational Manual* [in Canada, *Workplace Hazardous Materials Identification System (WHMIS) Reference Manual*] developed by the National Paint and Coatings Association
(3) List of any hazardous materials that are in excess of 1.0 percent of the contents
(4) List of each chemical in excess of 5.0 percent of the contents
(5) Information as to what is hazardous about the agent in accordance with the MSDS
(6) Manufacturer's or service agency's name, mailing address, and phone number

4.3* Instruction Manual.

4.3.1 The owner or the owner's agent shall be provided with a fire extinguisher instruction manual that details condensed instructions and cautions necessary to the installation, operation, inspection, and maintenance of the fire extinguisher(s).

4.3.2 The manual shall refer to this standard as a source of detailed instruction.

4.4 Obsolete Fire Extinguishers. The following types of fire extinguishers are considered obsolete and shall be removed from service:

(1) Soda acid
(2) Chemical foam (excluding film-forming agents)
(3) Vaporizing liquid (e.g., carbon tetrachloride)
(4) Cartridge-operated water
(5) Cartridge-operated loaded stream
(6) Copper or brass shell (excluding pump tanks) joined by soft solder or rivets
(7) Carbon dioxide extinguishers with metal horns
(8) Solid charge–type AFFF extinguishers (paper cartridge)
(9) Pressurized water fire extinguishers manufactured prior to 1971
(10) Any extinguisher that needs to be inverted to operate
(11) Any stored pressure extinguisher manufactured prior to 1955
(12) Any extinguishers with 4B, 6B, 8B, 12B, and 16B fire ratings
(13) Stored-pressure water extinguishers with fiberglass shells (pre-1976)

4.4.1* Dry chemical stored-pressure extinguishers manufactured prior to October 1984 shall be removed from service at the next 6-year maintenance interval or the next hydrotest, whichever comes first.

4.4.1.1 Subsection 4.4.1 shall not apply to wheeled-type dry chemical stored-pressure fire extinguishers.

4.4.2 Any fire extinguisher that can no longer be serviced in accordance with the manufacturer's maintenance manual is considered obsolete and shall be removed from service.

Chapter 5 Selection of Portable Fire Extinguishers

5.1 General Requirements. The selection of fire extinguishers for a given situation shall be determined by the applicable requirements of Sections 5.2 through 5.6 and the following factors:

(1) Type of fire most likely to occur
(2) Size of fire most likely to occur
(3) Hazards in the area where the fire is most likely to occur
(4) Energized electrical equipment in the vicinity of the fire
(5) Ambient temperature conditions
(6) Other factors *(See Section H.2.)*

5.2 Classifications of Fires. Fires shall be classified in accordance with the guidelines specified in 5.2.1 through 5.2.5.

5.2.1 Class A Fires. Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.

5.2.2 Class B Fires. Class B fires are fires in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases.

5.2.3 Class C Fires. Class C fires are fires that involve energized electrical equipment.

5.2.4 Class D Fires. Class D fires are fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

5.2.5 Class K Fires. Class K fires are fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats).

5.3 Extinguisher Classification System.

5.3.1 The classification of fire extinguishers shall consist of a letter that indicates the class of fire on which a fire extinguisher has been found to be effective.

5.3.1.1 Fire extinguishers classified for use on Class A or Class B hazards shall be required to have a rating number preceding the classification letter that indicates the relative extinguishing effectiveness.

5.3.1.2 Fire extinguishers classified for use on Class C, Class D, or Class K hazards shall not be required to have a number preceding the classification letter.

5.3.2 Fire extinguishers shall be selected for the class(es) of hazards to be protected in accordance with 5.3.2.1 through 5.3.2.5. *(For specific hazards, see Section 5.5.)*

5.3.2.1* Fire extinguishers for the protection of Class A hazards shall be selected from types that are specifically listed and labeled for use on Class A fires. *(For halon agent–type extinguishers, see 5.3.2.6.)*

5.3.2.2* Fire extinguishers for the protection of Class B hazards shall be selected from types that are specifically listed and labeled for use on Class B fires. *(For halon agent–type extinguishers, see 5.3.2.6.)*

5.3.2.3* Fire extinguishers for the protection of Class C hazards shall be selected from types that are specifically listed and labeled for use on Class C hazards. *(For halon agent–type fire extinguishers, see 5.3.2.6.)*

5.3.2.4* Fire extinguishers and extinguishing agents for the protection of Class D hazards shall be of the types specifically

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listed and labeled for use on the specific combustible metal hazard.

5.3.2.5 Fire extinguishers for the protection of Class K hazards shall be selected from types that are specifically listed and labeled for use on Class K fires.

5.3.2.6* Use of halon agent fire extinguishers shall be limited to applications where a clean agent is necessary to extinguish fire efficiently without damaging the equipment or area being protected or where the use of alternative agents has the potential to cause a hazard to personnel in the area.

5.3.2.6.1* Placement of portable fire extinguishers containing halogenated agents shall conform to minimum confined space volume requirement warnings contained on the fire extinguisher nameplates.

5.3.2.7* Wheeled fire extinguishers shall be considered for hazard protection in areas in which a fire risk assessment has shown the following:

(1) High hazard areas are present.
(2) Limited available personnel are present, thereby requiring an extinguisher that has the following features:
    (a) High agent flow rate
    (b) Increased agent stream range
    (c) Increased agent capacity

5.4 Classification of Hazards.

5.4.1 Classifying Occupancy Hazard. Rooms or areas shall be classified as being light (low) hazard, ordinary (moderate) hazard, or extra (high) hazard.

5.4.1.1* Light (Low) Hazards. Light (low) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustibles and Class B flammables are low and fires with relatively low rates of heat release are expected. These occupancies consist of fire hazards having normally expected quantities of Class A combustible furnishings, and/or the total quantity of Class B flammables typically expected to be present is less than 1 gal (3.8 L) in any room or area.

5.4.1.2* Ordinary (Moderate) Hazards. Ordinary (moderate) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustible materials and Class B flammables are moderate and fires with moderate rates of heat release are expected. These occupancies consist of fire hazards that only occasionally contain Class A combustible materials beyond normal anticipated furnishings, and/or the total quantity of Class B flammables typically expected to be present is from 1 gal to 5 gal (3.8 L to 18.9 L) in any room or area.

5.4.1.3* Extra (High) Hazards. Extra (high) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustible material are high or where high amounts of Class B flammables are present and rapidly developing fires with high rates of heat release are expected. These occupancies consist of fire hazards involved with the storage, packaging, handling, or manufacture of Class A combustibles, and/or the total quantity of Class B flammables expected to be present is more than 5 gal (18.9 L) in any room or area.

5.4.1.4 Limited areas of greater or lesser hazard shall be protected as required.

5.4.2* Selection by Occupancy. Fire extinguishers shall be provided for the protection of both the building structure and the occupancy hazards contained therein regardless of the presence of any fixed fire suppression systems.

5.4.2.1 Required building protection shall be provided by fire extinguishers for Class A fires.

5.4.2.2* Occupancy hazard protection shall be provided by fire extinguishers for such Class A, B, C, D, or K fire potentials as might be present.

5.4.2.3 Fire extinguishers provided for building protection shall be permitted to also be considered for the protection of occupancies having a Class A fire potential.

5.4.2.4 Buildings having an occupancy hazard subject to Class B or Class C fires, or both, shall have a standard complement of Class A fire extinguishers for building protection, plus additional Class B or Class C fire extinguishers, or both.

5.4.2.5 Where fire extinguishers have more than one letter classification (such as 2-A:20-B:C), they shall be permitted to satisfy the requirements of each letter class.

5.5 Selection for Specific Hazards.

5.5.1 Class B Fires.

5.5.1.1* Extinguishers for Pressurized Flammable Liquids and Pressurized Gas Fires.

5.5.1.1.1 Selection of fire extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment.

5.5.1.1.2* Large capacity dry chemical extinguishers of 10 lb (4.54 kg) or greater and a discharge rate of 1 lb/sec (0.45 kg/sec) or more shall be used to protect these hazards.

• **5.5.2 Three-Dimensional Fires.** Large capacity dry chemical extinguishers of 10 lb (4.54 kg) or greater and having a discharge rate of 1 lb/sec (0.45 kg/sec) or more shall be used to protect these hazards.

5.5.3 Water-Soluble Flammable Liquid Fires (Polar Solvents). Aqueous film-forming foam (AFFF) and film-forming fluoroprotein foam (FFFP) types of fire extinguishers shall not be used for the protection of water-soluble flammable liquids, such as alcohols, acetone, esters, ketones, and so forth, unless specifically referenced on the fire extinguisher nameplate.

5.5.4 Obstacle Fires. Selection of a fire extinguisher for this type of hazard shall be based on one of the following:

(1) Extinguisher containing a vapor-suppressing foam agent
(2)*Multiple extinguishers containing non-vapor-suppressing Class B agents intended for simultaneous application
(3) Larger capacity extinguishers of 10 lb (4.54 kg) or greater and a minimum discharge rate of 1 lb/sec (0.45 kg/sec)

5.5.5* Class K Cooking Media Fires. Fire extinguishers provided for the protection of cooking appliances that use combustible cooking media (vegetable or animal oils and fats) shall be listed and labeled for Class K fires.

5.5.5.1 Class K fire extinguishers manufactured after January 1, 2002, shall not be equipped with extended wand–type discharge devices.

5.5.5.2 Fire extinguishers installed specifically for the protection of cooking appliances that use combustible cooking media (animal or vegetable oils and fats) without a Class K rating shall be removed from service.

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5.5.5.3* A placard shall be conspicuously placed near the extinguisher that states that the fire protection system shall be actuated prior to using the fire extinguisher.

5.5.6* Electronic Equipment Fires. Fire extinguishers for the protection of delicate electronic equipment shall be selected from types specifically listed and labeled for Class C hazards. *(See 5.3.2.3.)*

5.5.6.1* Dry chemical fire extinguishers shall not be installed for the protection of delicate electronic equipment.

5.5.7 Areas Containing Oxidizers.

5.5.7.1 Only water-type extinguishers shall be installed in areas containing oxidizers, such as pool chemicals.

5.5.7.2 Multipurpose dry chemical fire extinguishers shall not be installed in areas containing oxidizers, such as pool chemicals.

5.6 Selection for Specific Locations.

5.6.1 Where portable fire extinguishers are required to be installed, the following documents shall be reviewed for the occupancies outlined in their respective scopes:

(1) NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*
(2) NFPA 32, *Standard for Drycleaning Plants*
(3) NFPA 58, *Liquefied Petroleum Gas Code*
(4) NFPA 86, *Standard for Ovens and Furnaces*
(5) NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*
(6) NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*
(7) NFPA 122, *Standard for Fire Prevention and Control in Metal/Nonmetal Mining and Metal Mineral Processing Facilities*
(8) NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*
(9) NFPA 302, *Fire Protection Standard for Pleasure and Commercial Motor Craft*
(10) NFPA 303, *Fire Protection Standard for Marinas and Boatyards*
(11) NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids*
(12) NFPA 407, *Standard for Aircraft Fuel Servicing*
(13) NFPA 408, *Standard for Aircraft Hand Portable Fire Extinguishers*
(14) NFPA 400, *Hazardous Materials Code*
(15) NFPA 410, *Standard on Aircraft Maintenance*
(16) NFPA 418, *Standard for Heliports*
(17) NFPA 498, *Standard for Safe Havens and Interchange Lots for Vehicles Transporting Explosives*
(18) NFPA 1192, *Standard on Recreational Vehicles*
(19) NFPA 1194, *Standard for Recreational Vehicle Parks and Campgrounds*

5.6.2 In no case shall the requirements of the documents in 5.6.1 be less than those specified in this standard.

Chapter 6 Installation of Portable Fire Extinguishers

6.1 General.

6.1.1* Number of Extinguishers. The minimum number of fire extinguishers needed to protect a property shall be determined as outlined in this chapter.

6.1.1.1 Additional extinguishers shall be permitted to be installed to provide more protection as necessary.

6.1.1.2 Fire extinguishers having ratings less than those specified in Table 6.2.1.1 and Table 6.3.1.1 shall be permitted to be installed, provided they are not used in fulfilling the minimum protective requirements of this chapter, except as modified in 6.2.1.3.1, 6.2.1.4, and 6.3.1.5.

6.1.2 Extinguisher Readiness. Portable fire extinguishers shall be maintained in a fully charged and operable condition and shall be kept in their designated places at all times when they are not being used.

6.1.3 Placement.

6.1.3.1 Fire extinguishers shall be conspicuously located where they are readily accessible and immediately available in the event of fire.

6.1.3.2 Fire extinguishers shall be located along normal paths of travel, including exits from areas.

6.1.3.3 Visual Obstructions.

6.1.3.3.1 Fire extinguishers shall not be obstructed or obscured from view.

6.1.3.3.2* In large rooms and in certain locations where visual obstructions cannot be completely avoided, means shall be provided to indicate the extinguisher location.

6.1.3.4* Portable fire extinguishers other than wheeled extinguishers shall be installed using any of the following means:

(1) Securely on a hanger intended for the extinguisher
(2) In the bracket supplied by the extinguisher manufacturer
(3) In a listed bracket approved for such purpose
(4) In cabinets or wall recesses

6.1.3.5 Wheeled fire extinguishers shall be located in designated locations.

6.1.3.6 Fire extinguishers installed under conditions where they are subject to dislodgement shall be installed in manufacturer's strap-type brackets specifically designed for this problem.

6.1.3.7 Fire extinguishers installed under conditions where they are subject to physical damage (e.g., from impact, vibration, the environment) shall be protected against damage.

6.1.3.8 Installation Height.

6.1.3.8.1 Fire extinguishers having a gross weight not exceeding 40 lb (18.14 kg) shall be installed so that the top of the fire extinguisher is not more than 5 ft (1.53 m) above the floor.

6.1.3.8.2 Fire extinguishers having a gross weight greater than 40 lb (18.14 kg) (except wheeled types) shall be installed so that the top of the fire extinguisher is not more than 3½ ft (1.07 m) above the floor.

6.1.3.8.3 In no case shall the clearance between the bottom of the hand portable fire extinguisher and the floor be less than 4 in. (102 mm).

6.1.3.9 Label Visibility.

6.1.3.9.1 Extinguishers' operating instructions shall be located on the front of the extinguisher and shall be clearly visible.

6.1.3.9.2 Hazardous materials identification systems (HMIS) labels, 6-year maintenance labels, hydrostatic test labels, or

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other labels shall not be located or placed on the front of the extinguisher.

6.1.3.9.3 The restrictions of 6.1.3.9.2 shall not apply to original manufacturer's labels, labels that specifically relate to the extinguisher's operation or fire classification, or inventory control labels specific to that extinguisher.

6.1.3.10 Cabinets.

6.1.3.10.1 Cabinets housing fire extinguishers shall not be locked, except where fire extinguishers are subject to malicious use and cabinets include a means of emergency access.

6.1.3.10.2 The location of fire extinguishers as described in 6.1.3.3.2 shall be marked conspicuously.

6.1.3.10.3 Fire extinguishers mounted in cabinets or wall recesses shall be placed so that the fire extinguisher's operating instructions face outward.

6.1.3.10.4* Where fire extinguishers are installed in closed cabinets that are exposed to elevated temperatures, the cabinets shall be provided with screened openings and drains.

6.1.3.11* Fire extinguishers shall not be exposed to temperatures outside the listed temperature range shown on the fire extinguisher label.

6.1.4 Antifreeze.

6.1.4.1 Fire extinguishers containing only plain water shall be protected to temperatures as low as −40°F (−40°C) by the addition of an antifreeze that is stipulated on the fire extinguisher nameplate.

6.1.4.2 Calcium chloride solutions shall not be used in stainless steel fire extinguishers.

6.2 Installations for Class A Hazards.

6.2.1 Fire Extinguisher Size and Placement for Class A Hazards.

6.2.1.1 Minimal sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of Table 6.2.1.1, except as modified by 6.2.1.3.1 and 6.2.1.4.

Table 6.2.1.1 Fire Extinguisher Size and Placement for Class A Hazards

Criteria	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum rated single extinguisher	2-A	2-A	4-A
Maximum floor area per unit of A	3000 ft^2	1500 ft^2	1000 ft^2
Maximum floor area for extinguisher	11,250 ft^2	11,250 ft^2	11,250 ft^2
Maximum travel distance to extinguisher	75 ft	75 ft	75 ft

For SI units, 1 ft = 0.305 m; 1 ft^2 = 0.0929 m^2.
Note: For maximum floor area explanations, see E.3.3.

6.2.1.2 Fire extinguishers shall be located so that the maximum travel distances shall not exceed those specified in Table 6.2.1.1, except as modified by 6.2.1.4. *(See Annex E.)*

6.2.1.3 Certain smaller fire extinguishers that are charged with a multipurpose dry chemical or a halogenated agent rated on Class B and Class C fires but have insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires shall not be used to meet the requirements of 6.2.1.

6.2.1.3.1 Fire extinguishers of lesser rating shall be permitted to be installed but shall not be considered as fulfilling any part of the requirements of Table 6.2.1.1, except as permitted in 6.2.1.3.1.1 and 6.2.1.3.1.2.

6.2.1.3.1.1 Up to two water-type extinguishers, each with 1-A rating, shall be permitted to be used to fulfill the requirements of one 2-A rated extinguisher.

6.2.1.3.1.2 Two 2½ gal (9.46 L) water-type extinguishers shall be permitted to be used to fulfill the requirements of one 4-A rated extinguisher.

6.2.1.4 Up to one-half of the complement of fire extinguishers specified in Table 6.2.1.1 shall be permitted to be replaced by uniformly spaced 1½ in. (38 mm) hose stations for use by the occupants of the building.

6.2.1.4.1 Where hose stations are so provided, they shall conform to NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*.

6.2.1.4.2 The location of hose stations and the placement of fire extinguishers shall be such that the hose stations do not replace more than every other fire extinguisher.

6.2.1.5 Where the area of the floor of a building is less than that specified in Table 6.2.1.1, at least one fire extinguisher of the minimum size recommended shall be provided.

6.2.1.6 The protection requirements shall be permitted to be fulfilled with fire extinguishers of higher rating, provided the travel distance to such larger fire extinguishers does not exceed 75 ft (22.9 m).

6.3 Installations for Class B Hazards.

6.3.1 Other Than for Fires in Flammable Liquids of Appreciable Depth.

6.3.1.1 Minimum sizes of fire extinguishers for the listed grades of hazard shall be provided in accordance with Table 6.3.1.1, except as modified by 6.3.1.5.

6.3.1.2 Fire extinguishers shall be located so that the maximum travel distances do not exceed those specified in Table 6.3.1.1. *(See Annex E.)*

6.3.1.2.1 Fire extinguishers of lesser rating, desired for small specific hazards within the general hazard area, shall be permitted to be installed but shall not be considered as fulfilling any part of the requirements of Table 6.3.1.1, except as modified by 6.3.1.5.

6.3.1.3 Up to three AFFF or FFFP fire extinguishers of at least 2½ gal (9.46 L) capacity shall be permitted to be used to fulfill extra (high) hazard requirements.

6.3.1.4 Two AFFF or FFFP fire extinguishers of at least 1.6 gal (6 L) capacity shall be permitted to be used to fulfill ordinary (moderate) hazard requirements.

Table 6.3.1.1 Fire Extinguisher Size and Placement for Class B Hazards

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers	
		ft	m
Light (low)	5-B	30	9.14
	10-B	50	15.25
Ordinary (moderate)	10-B	30	9.14
	20-B	50	15.25
Extra (high)	40-B	30	9.14
	80-B	50	15.25

Notes:
(1) The specified ratings do not imply that fires of the magnitudes indicated by these ratings will occur, but rather they are provided to give the operators more time and agent to handle difficult spill fires that have the potential to occur.
(2) For fires involving water-soluble flammable liquids, see 5.5.3.
(3) For specific hazard applications, see Section 5.5.

6.3.1.5 Two or more fire extinguishers of lower rating shall not be used to fulfill the protection requirements of Table 6.3.1.1 except as permitted by 6.3.1.3 and 6.3.1.4.

6.3.1.6 The protection requirements shall be permitted to be fulfilled with fire extinguishers of higher ratings, provided the travel distance to such larger fire extinguishers does not exceed 50 ft (15.25 m).

6.3.2 Flammable Liquids of Appreciable Depth.

6.3.2.1 Portable fire extinguishers shall not be installed as the sole protection for flammable liquid hazards of appreciable depth where the surface area exceeds 10 ft^2 (0.93 m^2).

6.3.2.2* Where personnel who are trained in extinguishing fires in the protected hazards are located on the premises and capable of responding immediately, the maximum surface area shall not exceed 20 ft^2 (1.86 m^2).

6.3.2.3 For flammable liquid hazards of appreciable depth, a Class B fire extinguisher shall be provided on the basis of at least 2 numerical units of Class B extinguishing potential per 1 ft^2 (0.09 m^2) of flammable liquid surface of the largest hazard area.

6.3.2.4 AFFF- or FFFP-type fire extinguishers shall be permitted to be provided on the basis of 1-B of protection per 1 ft^2 (0.09 m^2) of hazard. *(For fires involving water-soluble flammable liquids, see 5.5.3.)*

6.3.2.5 Two or more fire extinguishers of lower ratings, other than AFFF- or FFFP-type fire extinguishers, shall not be used in lieu of the fire extinguisher required for the largest hazard area.

6.3.2.6 Up to three AFFF- or FFFP-type fire extinguishers shall be permitted to fulfill the requirements, provided the sum of the Class B ratings meets or exceeds the value required for the largest hazard area.

6.3.2.7 Travel distances for portable fire extinguishers shall not exceed 50 ft (15.25 m). *(See Annex E.)*

6.3.2.7.1 Scattered or widely separated hazards shall be individually protected.

6.3.2.7.2 A fire extinguisher in the proximity of a hazard shall be located to be accessible in the presence of a fire without undue danger to the operator.

6.4* Installations for Class C Hazards.

6.4.1 Fire extinguishers with Class C ratings shall be required where energized electrical equipment can be encountered.

6.4.2 The requirement in 6.4.1 shall include situations where fire either directly involves or surrounds electrical equipment.

6.4.3 Because fire is a Class A or Class B hazard, the fire extinguishers shall be sized and located on the basis of the anticipated Class A or Class B hazard.

6.5 Installations for Class D Hazards.

6.5.1 Fire extinguishers or extinguishing agents with Class D ratings shall be provided for fires involving combustible metals.

6.5.2 Fire extinguishers or extinguishing agents (media) shall be located not more than 75 ft (22.9 m) of travel distance from the Class D hazard. *(See Section E.6.)*

6.5.3 Portable fire extinguishers or extinguishing agents (media) for Class D hazards shall be provided in those work areas where combustible metal powders, flakes, shavings, chips, or similarly sized products are generated.

6.5.4 Size determination shall be on the basis of the specific combustible metal, its physical particle size, area to be covered, and recommendations by the fire extinguisher manufacturer based on data from control tests.

6.6 Installations for Class K Hazards.

6.6.1 Class K fire extinguishers shall be provided for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats).

6.6.2 Maximum travel distance shall not exceed 30 ft (9.15 m) from the hazard to the extinguishers.

6.6.3 All solid fuel cooking appliances (whether or not under a hood) with fire boxes of 5 ft^3 (0.14 m^3) volume or less shall have at least a listed 2-A rated water-type fire extinguisher or a 1.6 gal (6 L) wet chemical fire extinguisher that is listed for Class K fires.

Chapter 7 Inspection, Maintenance, and Recharging of Portable Fire Extinguishers

7.1* General.

7.1.1 Responsibility. The owner or designated agent or occupant of a property in which fire extinguishers are located shall be responsible for inspection, maintenance, and recharging. *(See 7.1.2.)*

7.1.2 Personnel.

7.1.2.1* Persons performing maintenance and recharging of extinguishers shall be certified.

7.1.2.1.1 Persons training to become certified shall be permitted to perform maintenance and recharging of extinguishers under the direct supervision and in the immediate presence of a certified person.

7.1.2.1.2* Certification requires that a person pass a test administered by an organization acceptable to the AHJ.

7.1.2.1.3 The test shall at a minimum be based upon knowledge of the chapters and annexes of this standard.

7.1.2.1.4 The testing process shall permit persons to use the standard during the test.

7.1.2.1.5 Persons passing the test required in 7.1.2.1.2 shall be issued a document or a certificate.

7.1.2.1.6 The document or certificate shall be made available when requested by the authority having jurisdiction.

7.1.2.2 Persons performing maintenance and recharging of extinguishers shall be trained and shall have available the appropriate manufacturer's servicing manual(s), the correct tools, recharge materials, lubricants, and manufacturer's replacement parts or parts specifically listed for use in the fire extinguisher.

7.1.2.3* Persons performing 30-day inspections shall not be required to be certified.

7.1.3 Replacement While Servicing. Fire extinguishers removed from service for maintenance or recharging shall be replaced by a fire extinguisher suitable for the type of hazard being protected and shall be of at least equal rating.

7.1.4 Tags or Labels.

7.1.4.1 Tags or labels intended for recording inspections, maintenance, or recharging shall not be placed on the front of the fire extinguishers.

7.1.4.2 Labels indicating fire extinguisher use or classification or both shall be permitted to be placed on the front of the fire extinguisher.

7.1.5 Electronic Monitoring Systems.

7.1.5.1 When used in conjunction with fire alarm systems, fire extinguisher electronic monitoring devices shall be inspected and maintained in accordance with *NFPA 72, National Fire Alarm and Signaling Code*, and 7.3.2.5.

7.1.5.2 When used in conjunction with non–fire alarm systems, fire extinguisher electronic monitoring devices shall be inspected and maintained as required in 7.1.5.2.1 through 7.1.5.2.3 and the manufacturer's listed installation and maintenance manual(s).

7.1.5.2.1 The connection to the electronic monitoring device shall be continuously supervised for integrity.

7.1.5.2.2 The power source for the electronic monitoring device shall be supervised for continuity of power.

7.1.5.2.3 The monitoring device shall be tested and maintained annually in accordance with 7.3.2.5.

FAIR USE

7.2 Inspection.

7.2.1 Frequency.

7.2.1.1* Fire extinguishers shall be manually inspected when initially placed in service.

7.2.1.2* Fire extinguishers shall be inspected either manually or by means of an electronic monitoring device/system at a minimum of 30-day intervals.

7.2.1.2.1 Where electronic monitoring is used and the specific extinguisher cannot be verified electronically, the extinguisher shall be continuously monitored for location.

7.2.1.3* Fire extinguishers shall be inspected at more frequent intervals when circumstances require.

7.2.2 Procedures. Periodic inspection or electronic monitoring of fire extinguishers shall include a check of at least the following items:

(1) Location in designated place
(2) No obstruction to access or visibility
(3) Pressure gauge reading or indicator in the operable range or position
(4) Fullness determined by weighing or hefting for self-expelling-type extinguishers, cartridge-operated extinguishers, and pump tanks
(5) Condition of tires, wheels, carriage, hose, and nozzle for wheeled extinguishers
(6) Indicator for nonrechargeable extinguishers using push-to-test pressure indicators

7.2.2.1 In addition to 7.2.2, fire extinguishers shall be visually inspected in accordance with 7.2.2.2 if they are located where any of the following conditions exists:

(1) High frequency of fires in the past
(2) Severe hazards
(3) Locations that make fire extinguishers susceptible to mechanical injury or physical damage
(4) Exposure to abnormal temperatures or corrosive atmospheres

7.2.2.2 Where required by 7.2.2.1, the following inspection procedures shall be in addition to those addressed in 7.2.2:

(1) Verifying that operating instructions on nameplates are legible and face outward
(2) Checking for broken or missing safety seals and tamper indicators
(3) Examination for obvious physical damage, corrosion, leakage, or clogged nozzle

7.2.3 Corrective Action. When an inspection of any fire extinguisher reveals a deficiency in any of the conditions listed in 7.2.2, immediate corrective action shall be taken.

7.2.3.1 Rechargeable Fire Extinguishers. When an inspection of any rechargeable fire extinguisher reveals a deficiency in any of the conditions listed in 7.2.2(3) or 7.2.2(4), the extinguisher shall be subjected to applicable maintenance procedures.

7.2.3.2 Nonrechargeable Dry Chemical Fire Extinguisher. When an inspection of any nonrechargeable dry chemical fire extinguisher reveals a deficiency in any of the conditions listed in 7.2.2(3), 7.2.2(4), or 7.2.2(6), the extinguisher shall be removed from further use, discharged, and destroyed at the direction of the owner or returned to the manufacturer.

7.2.3.3 Nonrechargeable Halon Agent Fire Extinguisher. When an inspection of any nonrechargeable fire extinguisher containing a halon agent reveals a deficiency in any of the conditions listed in 7.2.2(3), 7.2.2(4), or 7.2.2(6), the extinguisher shall be removed from service, not discharged, and returned to the manufacturer, a fire equipment dealer, or a distributor to permit recovery of the halon.

7.2.4 Inspection Record Keeping.

7.2.4.1 Personnel making manual inspections shall keep records of all fire extinguishers inspected, including those found to require corrective action.

7.2.4.2 Where electronically monitored systems are employed for inspections, records shall be kept for fire extinguishers found to require corrective action.

7.2.4.3 Where at least monthly manual inspections are conducted, the date the manual inspection was performed and the initials of the person performing the inspection shall be recorded.

7.2.4.4 Where manual inspections are conducted, records for manual inspections shall be kept on a tag or label attached to the fire extinguisher, on an inspection checklist maintained on file, or by an electronic method.

7.2.4.5 Records shall be kept to demonstrate that at least the last 12 monthly inspections have been performed.

7.2.4.6 Fire extinguishers inspected via electronic monitoring, whereby the extinguisher causes a signal at a control unit when a deficiency in any of the conditions listed in 7.2.2 occurs, shall provide record keeping in the form of an electronic event log at the control panel.

7.3* Maintenance.

7.3.1 Frequency.

7.3.1.1 All Fire Extinguishers.

7.3.1.1.1 Fire extinguishers shall be subjected to maintenance at intervals of not more than 1 year, at the time of hydrostatic test, or when specifically indicated by an inspection or electronic notification.

7.3.1.1.2 Fire extinguishers shall be internally examined at intervals not exceeding those specified in Table 7.3.1.1.2.

7.3.1.2 Stored-Pressure Types.

7.3.1.2.1 Six-Year Internal Examination. Every 6 years, stored-pressure fire extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to the applicable internal examination procedures as detailed in the manufacturer's service manual and this standard.

FAIR USE

7.3.1.2.1.1 When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the 6-year requirement shall begin from that date.

7.3.1.2.1.2* The removal of agent from halon agent fire extinguishers shall only be done using a listed halon closed recovery system.

7.3.1.2.1.3 Nonrechargeable fire extinguishers shall not be required to comply with 7.3.1.2.1.2 and shall not be hydrostatically tested but shall be removed from service at a maximum interval of 12 years from the date of manufacture.

7.3.1.2.1.4 Nonrechargeable halon agent fire extinguishers shall be disposed of in accordance with 7.2.3.3.

7.3.1.2.2 When subjected to temperatures at or above their listed rating, stored-pressure fire extinguishers that require a 12-year hydrostatic test shall be emptied and subjected to the applicable maintenance and recharge procedures on an annual basis.

7.3.1.2.2.1 The loaded stream charge shall be permitted to be recovered and re-used, provided it is subjected to agent analysis in accordance with the extinguisher manufacturer's instructions.

7.3.1.2.3 Loaded Stream Charge. Stored-pressure types of fire extinguishers containing a loaded stream agent shall be disassembled on an annual basis and subjected to complete maintenance.

Table 7.3.1.1.2 Maintenance Involving Internal Examination

Extinguisher Type	Internal Examination Interval (years)
Stored-pressure loaded stream and antifreeze	1
Pump tank water and pump tank calcium chloride–based	1
Dry chemical, cartridge- and cylinder-operated, with mild steel shells	1*
Dry powder, cartridge- and cylinder-operated, with mild steel shells	1*
Wetting agent	1
Stored-pressure water	5
AFFF (aqueous film-forming foam)	†
FFFP (film-forming fluoroprotein foam)	†
Stored-pressure dry chemical, with stainless steel shells	5
Carbon dioxide	5
Wet chemical	5
Dry chemical stored-pressure, with mild steel shells, brazed brass shells, and aluminum shells	6
Halogenated agents	6
Dry powder, stored-pressure, with mild steel shells	6

*Dry chemical and dry powder in cartridge- or cylinder-operated extinguishers are examined annually.

†The extinguishing agent in liquid charge-type AFFF and FFFP extinguishers is replaced every 3 years, and an internal examination (teardown) is normally conducted at that time.

7.3.1.2.4 When the applicable maintenance procedures are performed during periodic recharging or hydrostatic testing, the 1-year requirement shall begin from that date.

7.3.1.3* Carbon Dioxide Hose Assemblies. A conductivity test shall be conducted annually on all carbon dioxide hose assemblies.

7.3.1.3.1 Carbon dioxide hose assemblies that fail the conductivity test shall be replaced.

7.3.1.3.2 Carbon dioxide hose assemblies that pass a conductivity test shall have the test information recorded on a durable weatherproof label that has a minimum size of ½ in. × 3 in. (13 mm × 76 mm).

7.3.1.3.2.1 The label shall be affixed to the hose by means of a heatless process.

7.3.1.3.2.2 The label shall include the following information:

(1) Month and year the test was performed, indicated by perforation, such as is done by a hand punch
(2) Name or initials of person performing the test and the name of the agency performing the test

7.3.1.4 Pressure Regulators. Pressure regulators provided with wheeled-type fire extinguishers shall be tested annually for outlet static pressure and flow rate in accordance with the manufacturer's instructions.

7.3.1.5* Wheeled Unit Hoses. Discharge hoses on wheeled extinguishers shall be coiled in a manner to prevent kinks and to allow rapid deployment in accordance with the manufacturer's instructions.

7.3.2* Procedures. Maintenance procedures shall include following the procedures detailed in the manufacturer's service manual and a thorough examination of the basic elements of the fire extinguisher and components of the electronic monitoring system, including the following:

(1) Mechanical parts of all fire extinguishers
(2) Extinguishing agent of cartridge- or cylinder-operated dry chemical, stored-pressure loaded stream, and pump tank fire extinguishers
(3) Expelling means of all fire extinguishers
(4) Physical appearance
(5)*Components of electronically monitored system
(6) Hoses on wheeled-type fire extinguishers completely uncoiled and examined for damage

7.3.2.1 Internal and External Examination.

7.3.2.1.1 Internal examination during annual maintenance shall not be required for nonrechargeable fire extinguishers, carbon dioxide fire extinguishers, or stored-pressure fire extinguishers, except for those types specified in 7.3.1.2.2.

7.3.2.1.2 The fire extinguishers listed in 7.3.2.1.1 shall be thoroughly examined externally in accordance with the applicable items of 7.3.2(1).

7.3.2.2* Seals or Tamper Indicators. At the time of the maintenance, the tamper seal of a rechargeable fire extinguisher shall be removed by operating the pull pin or locking device.

7.3.2.2.1 After the applicable maintenance procedures are completed, a new listed tamper seal shall be installed.

7.3.2.2.2 Tamper indicators on nonrechargeable-type extinguishers shall not be removed.

7.3.2.3* Boots, Foot Rings, and Attachments. All removable extinguisher boots, foot rings, and attachments shall be removed to accommodate thorough annual cylinder examinations.

7.3.2.4 Physical Appearance. A visual examination of the extinguisher shall be made to detect obvious physical damage, corrosion, or nozzle blockage and to verify that the operating instructions are present, legible, and facing forward and that the HMIS information is present and legible.

7.3.2.5 Electronic Monitoring. The components of the monitoring device/system shall be tested and maintained annually in accordance with the manufacturer's listed maintenance manual with the following items as a minimum:

(1) Power supply inspection/battery change
(2) Obstruction sensor inspection
(3) Location sensor inspection
(4) Pressure indication inspection
(5) Connection continuity inspection *(see 7.3.2.5.1 and 7.3.2.5.2)*

7.3.2.5.1 One hundred percent of all units shall be tested upon initial installation or reacceptance with verification of receipt of signal at the control panel or a local alarm.

7.3.2.5.2 Twenty percent of units shall be tested annually on a rotating basis so that all units are tested within a 5-year period.

7.3.3* Maintenance Record Keeping. Each fire extinguisher shall have a tag or label securely attached that indicates the month and year the maintenance was performed, identifies the person performing the work, and identifies the name of the agency performing the work.

7.3.3.1* Six-Year Service Label. Fire extinguishers that pass the applicable 6-year requirement of 7.3.1.2.1 shall have the maintenance information recorded on a durable weatherproof label that is a minimum size of 2 in. × 3½ in. (51 mm × 89 mm).

7.3.3.1.1 The new label shall be affixed to the shell by a heatless process, and any old maintenance labels shall be removed.

7.3.3.1.2 These labels shall be of the self-destructive type when their removal from a fire extinguisher is attempted.

7.3.3.1.3 The label shall include the following information:

(1) Month and year the maintenance was performed, indicated by a perforation such as is done by a hand punch
(2) Name or initials of the person performing the maintenance and name of the agency performing the maintenance

7.3.3.2* Verification-of-Service Collar (Maintenance or Recharging).

7.3.3.2.1 Each extinguisher that has undergone maintenance that includes internal examination or that has been recharged *(see 7.4.5.2)* shall have a verification-of-service collar located around the neck of the container.

7.3.3.2.1.1 The collar shall contain a single circular piece of uninterrupted material forming a hole of a size that does not permit the collar assembly to move over the neck of the container unless the valve is completely removed.

7.3.3.2.1.2 The collar shall not interfere with the operation of the fire extinguisher.

7.3.3.2.1.3 The collar shall include the following information:

(1) Month and year the service was performed, indicated by a perforation such as is done by a hand punch
(2) Name of the agency performing the maintenance or recharge

7.3.3.2.2 Cartridge- or cylinder-operated fire extinguishers shall not be required to comply with 7.3.3.2.1.

7.3.3.2.3 New extinguishers requiring an initial charge in the field (such as pressurized water extinguishers, AFFF, FFFP, or wet chemical) shall not be required to have a verification-of-service collar installed.

7.4 Recharging.

7.4.1* General.

7.4.1.1 All rechargeable-type fire extinguishers shall be recharged after any use or as indicated by an inspection or when maintenance is performed.

7.4.1.2* When the recharging is performed, the recommendations of the manufacturer shall be followed. *(For recharge chemicals, see 7.4.3.1.)*

7.4.1.3* The amount of recharge agent shall be verified by weighing.

7.4.1.3.1 The recharged gross weight shall be the same as the gross weight that is marked on the nameplate.

FOR USE

7.4.1.3.1.1 Weight scales used for the maintenance and recharge of fire extinguishers shall have the reading increments and the accuracy necessary to verify the charge weights required in the service manuals and on the nameplates.

7.4.1.3.2 For those fire extinguishers that do not have the gross weight marked on the nameplate or valve, a permanent label that indicates the gross weight shall be affixed to the cylinder.

7.4.1.3.3 The added label containing the gross weight shall be a durable material of a pressure-sensitive, self-destruct type. *(For stored-pressure water-type extinguishers, see 7.4.3.10.)*

7.4.1.3.4 Pump tank water and pump tank calcium chloride–based antifreeze types shall not be required to have weight marked.

7.4.1.3.5* After recharging, a leak test shall be performed on stored-pressure and self-expelling types of fire extinguishers.

7.4.1.4 Conversion of Fire Extinguisher Types.

7.4.1.4.1 No fire extinguisher shall be converted from one type to another, nor shall any fire extinguisher be converted to use a different type of extinguishing agent.

7.4.1.4.2 Fire extinguishers shall not be used for any purpose other than that of a fire extinguisher.

7.4.2 Frequency.

7.4.2.1 Pump Tank. Every 12 months, pump tank water and pump tank calcium chloride–based antifreeze types of fire extinguishers shall be recharged with new chemicals or water as applicable.

7.4.2.2 Wetting Agent. The agent in stored-pressure wetting agent fire extinguishers shall be replaced annually.

7.4.2.2.1 Only the agent specified on the nameplate shall be used for recharging.

7.4.2.2.2 The use of water or any other additives shall be prohibited.

7.4.2.3 AFFF and FFFP.

7.4.2.3.1 The premixed agent in liquid charge–type AFFF and FFFP fire extinguishers shall be replaced at least once every 3 years.

7.4.2.3.2 Only the foam agent specified on the extinguisher nameplate shall be used for recharge.

7.4.2.3.3 The agent in nonpressurized AFFF and FFFP fire extinguishers that is subjected to agent analysis in accordance with manufacturer's instructions shall not be required to comply with 7.4.2.3.1.

7.4.3 Procedures.

7.4.3.1* Recharge Agents.

7.4.3.1.1 Only those agents specified on the nameplate or agents proven to have equal chemical composition, physical characteristics, and fire-extinguishing capabilities shall be used.

7.4.3.1.2 Agents listed specifically for use with that fire extinguisher shall be considered to meet these requirements.

7.4.3.2* Mixing of Dry Chemicals. Multipurpose dry chemicals shall not be mixed with alkaline-based dry chemicals.

7.4.3.3 Topping Off.

7.4.3.3.1 The remaining dry chemical in a discharged fire extinguisher shall be permitted to be re-used, provided that it is thoroughly checked for the proper type, contamination, and condition.

7.4.3.3.2 Dry chemical found to be of the wrong type or contaminated shall not be re-used.

7.4.3.4 Dry Chemical Agent Re-Use.

7.4.3.4.1 Fire extinguishers removed for 6-year maintenance or hydrostatic testing shall be emptied.

7.4.3.4.2 The dry chemical agent shall be permitted to be re-used, provided a closed recovery system is used and the agent is stored in a sealed container to prevent contamination.

7.4.3.4.3 Prior to re-use, the dry chemical shall be thoroughly checked for the proper type, contamination, and condition.

7.4.3.4.4 Where doubt exists with respect to the type, contamination, or condition of the dry chemical, the dry chemical shall be discarded.

7.4.3.4.5 Dry Chemical Closed Recovery System.

7.4.3.4.5.1 The system shall be constructed in a manner that does not introduce foreign material into the agent being recovered.

7.4.3.4.5.2 The system shall have a means for visual inspection of the recovered agent for contaminants.

7.4.3.5 Dry Powder.

7.4.3.5.1 Pails or drums containing dry powder agents for scoop or shovel application for use on metal fires shall be kept full and covered at all times.

7.4.3.5.2 The dry powder shall be replaced if found damp. *(See A.7.4.3.1.)*

7.4.3.6* Removal of Moisture. For all non-water types of fire extinguishers, any moisture shall be removed before recharging.

7.4.3.7* Halogenated Agent. Halogenated agent fire extinguishers shall be charged with only the type and weight of agent specified on the nameplate.

7.4.3.8 Halogenated Agent Re-Use.

7.4.3.8.1 The removal of Halon 1211 from fire extinguishers shall be done using only a listed halon closed recovery system.

7.4.3.8.2 The removal of agent from other halogenated agent fire extinguishers shall be done using only a closed recovery system.

7.4.3.8.3 The fire extinguisher shall be examined internally for contamination or corrosion or both.

7.4.3.8.4 The halogenated agent retained in the system recovery cylinder shall be re-used only if no evidence of internal contamination is observed in the fire extinguisher cylinder.

7.4.3.8.5 Halogenated agent removed from fire extinguishers that exhibits evidence of internal contamination or corrosion shall be processed in accordance with the fire extinguisher manufacturer's instructions.

FAIR USE

7.4.3.9* Carbon Dioxide.

7.4.3.9.1 The vapor phase of carbon dioxide shall be not less than 99.5 percent carbon dioxide.

7.4.3.9.2 The water content shall be not more than 60 parts per million (ppm) by weight at −52°F (−47°C) dew point.

7.4.3.9.3 Oil content shall not exceed 10 ppm by weight.

7.4.3.10* Water Types. The amount of liquid agent shall be determined by using one of the following:

(1) Exact measurement by weight
(2) Exact measurement by volume
(3) Anti-overfill tube, if provided
(4) Fill mark on fire extinguisher shell, if provided

7.4.3.10.1 Only the agent specified on the extinguisher nameplate shall be used for recharge.

7.4.3.11 Wet Chemical and Water Mist Agent Re-Use.

7.4.3.11.1 Wet chemical and water mist agents shall not be re-used.

7.4.3.11.2 If a wet chemical or water mist extinguisher is partially discharged, all remaining wet chemical or water mist shall be discarded.

7.4.3.11.3 Wet chemical or water mist agent shall be discarded and replaced at the hydrostatic test interval.

7.4.3.11.3.1 Only the agent specified on the extinguisher nameplate shall be used for recharge.

7.4.4 Precautionary Pressurization Measures.

7.4.4.1* Pressure Gauges. Replacement pressure gauges shall have the correct indicated charging (service) pressure, shall be marked for use with the agent in the fire extinguisher, and shall be compatible with the fire extinguisher valve body material.

7.4.4.2 Stored-Pressure Fire Extinguishers.

7.4.4.2.1 A rechargeable stored-pressure-type fire extinguisher shall be pressurized only to the charging pressure specified on the fire extinguisher nameplate.

7.4.4.2.1.1 The manufacturer's pressurizing adapter shall be connected to the valve assembly before the fire extinguisher is pressurized.

7.4.4.2.1.2 A regulated source of pressure, set no higher than 25 psi (172 kPa) above the operating (service) pressure, shall be used to pressurize fire extinguishers.

7.4.4.2.1.3 The gauge used to set the regulated source of pressure shall be calibrated at least annually.

7.4.4.2.2 An unregulated source of pressure, such as a nitrogen cylinder without a pressure regulator, shall not be used because the fire extinguisher has the potential to be overpressurized and possibly rupture.

7.4.4.2.3* A fire extinguisher shall not be left connected to the regulator of a high-pressure source for an extended period of time.

7.4.4.3 Pressurizing Gas. Only standard industrial-grade nitrogen with a dew point of −60°F (−51°C) or lower (CGA nitrogen specification G10.1, grades D through P) shall be used to pressurize stored-pressure dry chemical and halogenated-type fire extinguishers that use nitrogen as a propellant.

7.4.4.3.1 Halogenated-type fire extinguishers that require argon shall be pressurized with argon with a dew point of −65°F (−54°C) or lower.

7.4.4.3.2 Compressed air through moisture traps shall not be used for pressurizing even though so stated in the instructions on older fire extinguishers.

7.4.4.3.3 Compressed air shall be permitted to be used from special compressor systems capable of delivering air with a dew point of −60°F (−51°C) or lower. *(See Annex J.)*

7.4.4.3.4 The special compressor system shall be equipped with an automatic monitoring and alarm system to ensure that the dew point remains at or below −60°F (−51°C) at all times.

7.4.4.3.5* Class D, wet chemical, water mist, and halocarbon fire extinguishers shall be repressurized only with the type of expellant gas referred to on the fire extinguisher label.

7.4.4.3.6 Compressed air without moisture removal devices shall be permitted for pressurizing water extinguishers.

7.4.5 Recharge Record Keeping.

7.4.5.1 Each fire extinguisher shall have a tag or label attached that indicates the month and year recharging was performed, identifies the person performing the service, and identifies the name of the agency performing the work.

7.4.5.2 A verification-of-service (maintenance or recharging) collar in accordance with 7.3.3.2 shall also be attached to the extinguisher.

7.4.5.2.1 Liquefied gas, halogenated agent, and carbon dioxide extinguishers that have been recharged without valve removal shall not be required to have a verification-of-service collar installed following recharge.

7.4.5.2.2 Cartridge- and cylinder-operated extinguishers shall not be required to have a verification-of-service collar installed. *(See 7.3.3.2.)*

Chapter 8 Hydrostatic Testing

8.1 General.

8.1.1 Pressure vessels used as fire extinguishers and specified components of fire extinguishers shall be hydrostatically tested in accordance with this chapter.

8.1.2 Cylinders and cartridges bearing U.S. Department of Transportation (DOT) or Transport Canada (TC) markings shall be retested in accordance with the applicable DOT or TC regulations.

8.1.2.1 Hydrostatic testing shall be performed by persons who are trained in pressure testing procedures and safeguards complying with 7.1.2 and who have testing equipment, facilities, and appropriate manufacturer's service manual(s) available.

8.1.2.1.1 Personnel performing hydrostatic testing shall be certified by an organization with a certification program acceptable to the authority having jurisdiction.

8.1.2.1.2 Hydrostatic testing facilities with a DOT certification [requalification identification number (RIN)] or a TC certification shall be permitted to perform the task of hydrostatic testing without having additional certification as a fire extinguisher technician as outlined in 7.1.2.

FAIR USE

8.1.2.1.3* Where hydrostatic testing is subcontracted to a facility described in 8.1.2.1.1, an extinguisher technician complying with 7.1.2 shall perform assembly and disassembly of valves and cylinders, replacement of any parts or components, and all other extinguisher service work.

8.1.3 A hydrostatic test shall always include both an internal and an external visual examination of the cylinder.

8.1.4 Hydrostatic testing shall be conducted using water or another compatible noncompressible fluid as the test medium.

8.1.4.1 Air or other gases shall not be used as the sole medium for pressure testing.

8.1.4.2 All air shall be vented prior to hydrostatic testing to prevent violent and dangerous failure of the cylinder.

8.1.5* Fire extinguishers having aluminum cylinders or shells suspected of being exposed to temperatures in excess of 350°F (177°C) shall be removed from service and subjected to a hydrostatic test.

8.2* Test Equipment.

8.2.1 Pressure Gauges.

8.2.1.1 Test pressure gauges shall be certified accurate to ±0.5 percent or better of the full range of the gauge.

8.2.1.2 Test pressure gauges shall be capable of being read to within 1 percent of the test pressure. Interpolation of midpoint between smallest graduations shall be permitted.

8.2.1.3 Test pressure gauges shall be capable of indicating 90 percent to 110 percent of the test pressure.

8.2.1.4 Pressure gauges used on test equipment shall be calibrated at least semiannually.

8.2.1.5 Master gauges or dead weight testers shall be calibrated at least annually.

8.2.2 Drying Equipment.

8.2.2.1 All hydrostatically tested cylinders and apparatus, except water-type extinguishers, shall be thoroughly dried after testing.

8.2.2.2 The temperature used for drying shall not exceed 150°F (66°C) inside the shell.

8.2.3 Test Equipment for High-Pressure Cylinders. The equipment for hydrostatic testing of high-pressure cylinders and cartridges (DOT 3 series) shall meet the specifications of CGA C-1, *Methods of Hydrostatic Testing of Compressed Gas Cylinders.*

8.2.4 Test Equipment for Low-Pressure Cylinders and Hose Assemblies (Proof Pressure Test).

8.2.4.1 Cylinders and hose assemblies shall be tested within a protective cage device or placed behind a protective shield that permits visual observation while under pressure for leaks, bulges, and other harmful defects.

8.2.4.2 A hydrostatic test pump, hand- or power-operated, shall be capable of producing not less than 150 percent of the test pressure and shall include appropriate check valves and fittings.

8.2.4.3 A flexible connection between the test pump and the test cylinder shall be provided so that it is possible to test through the cylinder opening, test bonnet, hose outlet, or nozzle, as applicable.

8.3 Frequency.

8.3.1 General. At intervals not exceeding those specified in Table 8.3.1, fire extinguishers shall be hydrostatically retested.

Table 8.3.1 Hydrostatic Test Intervals for Extinguishers

Extinguisher Type	Test Interval (years)
Stored-pressure water, water mist, loaded stream, and/or antifreeze	5
Wetting agent	5
AFFF (aqueous film-forming foam)	5
FFFP (film-forming fluoroprotein foam)	5
Dry chemical with stainless steel shells	5
Carbon dioxide	5
Wet chemical	5
Dry chemical, stored-pressure, with mild steel shells, brazed brass shells, or aluminum shells	12
Dry chemical, cartridge- or cylinder-operated, with mild steel shells	12
Halogenated agents	12
Dry powder, stored-pressure, cartridge- or cylinder-operated, with mild steel shells	12

8.3.1.1 The hydrostatic retest shall be conducted within the calendar year of the specified test interval.

8.3.1.2 In no case shall an extinguisher be recharged if it is beyond its specified retest date. *(For nonrechargeable fire extinguishers, see 7.3.1.2.1.3.)*

8.3.2 Cylinders and Cartridges.

8.3.2.1 Nitrogen cylinders, argon cylinders, carbon dioxide cylinders, or cartridges used for inert gas storage that are used as expellants for wheeled fire extinguishers and carbon dioxide extinguishers shall be hydrostatically tested every 5 years.

8.3.2.1.1 Cylinders (except those charged with carbon dioxide) complying with 49 CFR 180.209(b) shall be permitted to be hydrostatically tested every 10 years in lieu of the requirement in 8.3.2.1.

8.3.2.2 Nitrogen cartridges, argon cartridges, and carbon dioxide cartridges used as expellants for hand portable fire extinguishers that have DOT or TC markings shall be hydrostatically tested or replaced according to the requirements of DOT or TC.

8.3.2.2.1 DOT 3E cartridges or TC 3EM cartridges shall be exempt from periodic hydrostatic retest.

8.3.3 Hose Assemblies.

8.3.3.1 A hydrostatic test shall be performed on fire extinguisher hose assemblies equipped with a shutoff nozzle at the end of the hose.

8.3.3.2 High-pressure and low-pressure accessory hose (other than agent discharge hose) used on wheeled extinguishers shall be hydrostatically tested.

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8.3.3.3 The test interval for 8.3.3.1 and 8.3.3.2 shall be the same as that specified for the fire extinguisher or fire extinguisher agent cylinder on which the hose is installed.

8.4 Extinguisher Examination.

8.4.1 General. If, at any time, a fire extinguisher shows evidence of dents, mechanical injury, or corrosion to the extent as to indicate weakness, it shall be condemned or hydrostatically retested subject to the provisions of 8.4.2 and Section 8.8.

8.4.1.1 Pump tanks shall not be required to comply with 8.4.1.

8.4.1.2 Nonrechargeable fire extinguishers other than halogenated agent types shall not be required to comply with 8.4.1 but shall be discharged and discarded where the fire extinguisher shows evidence of dents, mechanical injury, or corrosion to the extent of indicating weakness.

8.4.1.3 Nonrechargeable halon agent–type fire extinguishers that show evidence of dents, mechanical injury, or corrosion to the extent indicating weakness shall be removed from service. *(Also see 7.2.3.3.)*

8.4.2* Examination of Cylinder Condition. Where a fire extinguisher cylinder or shell has one or more of the following conditions, it shall not be hydrostatically tested but shall be condemned or destroyed by the owner or at the owner's direction:

(1)*Where repairs by soldering, welding, brazing, or use of patching compounds exist
(2) Where the cylinder threads are worn, corroded, broken, cracked, or nicked
(3) Where corrosion has caused pitting, including pitting under a removable nameplate or nameband assembly
(4) Where the fire extinguisher has been exposed to excessive heat, flame, or fire
(5) Where a calcium chloride–type extinguishing agent was used in a stainless steel fire extinguisher
(6) Where the shell is of copper or brass construction joined by soft solder or rivets
(7) Where the depth of a dent exceeds ⅒ of the greatest dimension of the dent if not in a weld or exceeds ¼ in. (6 mm) if the dent includes a weld
(8) Where any local or general corrosion, cuts, gouges, or dings have removed more than 10 percent of the minimum cylinder wall thickness
(9) Where a fire extinguisher has been used for any purpose other than that of a fire extinguisher

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8.5 Testing Procedures.

8.5.1 General.

8.5.1.1 The pressure in a hydrostatic test of a cylinder shall be maintained for a minimum of 30 seconds, but for no less time than is required for complete expansion of the cylinder and to complete the visual examination of the cylinder.

8.5.1.2 All valves, internal parts, and hose assemblies shall be removed, and the fire extinguisher shall be emptied before testing.

8.5.1.2.1 On certain dry chemical and dry powder fire extinguishers (cartridge-operated), where the manufacturer recommends that certain internal parts not be removed, those parts shall not be removed.

8.5.1.3 All types of extinguishers except water type shall have all traces of extinguishing agents removed from the inside of the extinguisher before they are filled with water.

8.5.1.4 A complete internal and external visual examination shall be conducted before any hydrostatic test.

8.5.1.4.1 The procedures for the visual examination shall be in accordance with 8.4.2.

8.5.2 Low-Pressure Cylinders.

8.5.2.1 The hydrostatic testing of dry chemical and dry powder fire extinguishers having an externally mounted gas cartridge shall have the cartridge and cartridge receiver removed and a plug inserted into the opening.

8.5.2.2 All hose shall be removed from cylinders prior to hydrostatic testing.

8.5.2.3 All stored-pressure extinguishers shall have the valve removed from the cylinder and replaced with a test bonnet or adapter.

8.5.2.4 All cartridge- or cylinder-operated wheeled extinguishers shall have pressure relief devices removed prior to the test.

8.5.2.4.1 All tests shall be conducted using test fittings and adapters.

8.5.2.4.2 The manufacturer's recommendations shall be followed.

8.5.2.5 Any distortion of the cylinder shall be cause for rejection.

8.5.2.6 A drop in pressure of the test gauge, which is an indication of a leak, shall be cause for rejection or retest.

8.5.2.7 Cylinders passing the hydrostatic test shall be thoroughly dried internally before being returned to service.

8.5.2.8 If heated air is used to dry the cylinders, the temperature shall not exceed 150°F (66°C) inside the shell.

8.5.3 High-Pressure Cylinders.

8.5.3.1 The hydrostatic testing of high-pressure cylinders and cartridges shall be in accordance with the procedures of TC, DOT, and CGA C-1, *Methods of Hydrostatic Testing of Compressed Gas Cylinders.*

8.5.3.2 Cylinders passing the hydrostatic test shall be thoroughly dried internally before being returned to service.

8.5.3.3 If heated air is used to dry the cylinders, the temperature shall not exceed 150°F (66°C) inside the shell.

8.5.4 Hose Assemblies.

8.5.4.1 The discharge valve shall be removed from the hose assembly without removal of any hose couplings.

8.5.4.2 The location of all couplings shall be marked prior to the hydrostatic test.

8.5.4.3 The hose shall be completely filled with water before testing.

8.5.4.4 For dry chemical and dry powder types, all traces of dry chemical or dry powder shall be removed prior to testing.

8.5.4.5 The hose assembly shall be placed within a protective cage or device whose design permits visual observation during the test.

8.5.4.6 Pressure shall be applied at a rate of rise such that the test pressure is reached in 1 minute.

8.5.4.7 Test pressure for hose assemblies shall be maintained for a minimum of 1 minute.

8.5.4.7.1 Observations shall be made to detect any distortion or leakage while the hose is pressurized.

8.5.4.7.2 Leakage, distortion, or permanent movement of couplings shall constitute a failure of the hydrostatic test.

8.5.4.8 Hose passing the hydrostatic test shall be thoroughly dried internally.

8.5.4.9 If heat is used, the temperature shall not exceed 150°F (66°C).

8.6 Test Pressures.

8.6.1 Low-Pressure Cylinders.

8.6.1.1 Stored-Pressure Types. Stored-pressure fire extinguishers shall be hydrostatically tested to the pressure specified on the extinguisher nameplate.

8.6.1.1.1 Where pressure is not specified on the extinguisher nameplate, the extinguisher shall be tested at the factory test pressure, not to exceed three times the extinguisher service pressure.

8.6.1.1.2 Fire extinguishers that are required to be returned to the manufacturer for recharging shall be hydrostatically tested only by the manufacturer.

8.6.1.2 Cartridge-Operated Types. Cartridge- or cylinder-operated dry chemical and dry powder types of extinguishers shall be hydrostatically tested at their original factory test pressure as shown on the nameplate or shell.

8.6.2 High-Pressure Cylinders.

8.6.2.1 DOT 3A, 3AA, or 3AL cylinders used as carbon dioxide extinguishers or nitrogen cylinders, argon cylinders, or carbon dioxide cylinders that are used with wheeled extinguishers shall be tested at ⁵⁄₃ the service pressure as stamped into the cylinder.

8.6.2.2 Carbon dioxide fire extinguishers having cylinder specification ICC3 shall be tested at 3000 psi (20.68 MPa).

8.6.3 Hose Assemblies.

8.6.3.1 Carbon dioxide hose assemblies requiring a hydrostatic pressure test shall be tested at 1250 psi (8619 kPa).

8.6.3.2 Dry chemical, dry powder, water, foam, and halogenated agent discharge hose assemblies requiring a hydrostatic pressure test shall be tested at 300 psi (2068 kPa) or at service pressure, whichever is higher.

8.6.3.3 Low-pressure accessory hose used on wheeled extinguishers shall be tested at 300 psi (2068 kPa).

8.6.3.4 High-pressure accessory hose used on wheeled extinguishers shall be tested at 3000 psi (20.68 MPa).

8.7 Recording of Hydrostatic Tests.

8.7.1* Records. Record of a hydrostatic test shall be maintained by the organization that performed the test until either the expiration of the test period or until the cylinder is again tested, whichever occurs first.

8.7.2* Low-Pressure Cylinders.

8.7.2.1 Fire extinguisher cylinders of the low-pressure non-DOT type that pass a hydrostatic test shall have the following information recorded on a label:

(1) Month and year the test was performed, indicated by a perforation, such as is done by a hand punch
(2) Test pressure used
(3) Name or initials of the person performing the test and name of the agency performing the test

8.7.2.2 The label shall meet the following criteria:

(1) Minimum size of 2 in. × 3½ in. (51 mm × 89 mm)
(2) Affixed by a heatless process
(3) Self-destructs when removed from a fire extinguisher cylinder shell
(4) Made of a durable, weatherproof material with a pressure-sensitive adhesive

8.7.2.3 In addition to the information in 8.7.2.1, DOT specification cylinders shall be labeled in accordance with 49 CFR 180.213(c)(1).

8.7.3 High-Pressure Cylinders and Cartridges.

8.7.3.1 Cylinders or cartridges that pass the hydrostatic test shall be stamped with the retester's identification number and the month and year of the retest per DOT/TC requirements.

8.7.3.2 Stamping shall be placed only on the shoulder, top head, neck, or foot ring (where provided) of the cylinder or in accordance with 49 CFR 180.213(c)(1).

8.7.4 Hose Assemblies. Hose assemblies that pass a hydrostatic test shall not require recording, labeling, or marking.

8.8 Condemning Extinguishers.

8.8.1 Fails Test or Examination. When a fire extinguisher cylinder, shell, or cartridge fails a hydrostatic pressure test or fails to pass a visual examination as specified in 8.4.2, it shall be condemned or destroyed by the owner or the owner's agent.

8.8.1.1 When a cylinder is required to be condemned, the retester shall notify the owner in writing that the cylinder is condemned and that it cannot be reused.

8.8.1.2 A condemned cylinder shall not be repaired.

8.8.2 Marking Condemned Extinguishers.

8.8.2.1 Condemned cylinders shall be stamped "CONDEMNED" on the top, head, shoulder, or neck with a steel stamp.

8.8.2.2 No person shall remove or obliterate the "CONDEMNED" marking.

8.8.2.3 Minimum letter height shall be ⅛ in. (3 mm).

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 Many fires are small at origin and can be extinguished by the use of portable fire extinguishers. Notification of the fire department as soon as a fire is discovered is strongly recommended. This alarm should not be delayed by awaiting results of the application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon the following conditions having been met:

(1) The fire extinguisher is located in accordance with the requirements of Chapter 6 and is in working order.
(2) The fire extinguisher is of the correct type for a fire that can occur.
(3) The fire is discovered while still small enough for the fire extinguisher to be effective.
(4) The fire is discovered by a person ready, willing, and able to use the fire extinguisher.

Fixed systems are covered by the following NFPA standards:

(1) NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*
(2) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*
(3) NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*
(4) NFPA 13, *Standard for the Installation of Sprinkler Systems*
(5) NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*
(6) NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*
(7) NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*
(8) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*
(9) NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*
(10) NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*
(11) NFPA 750, *Standard on Water Mist Fire Protection Systems*
(12) NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*

A.1.2 The owner or occupant of a property in which fire extinguishers are located has an obligation for the care and use of these extinguishers at all times. The nameplate(s) and instruction manual should be read and thoroughly understood by all persons who could be expected to use the fire extinguishers.

To discharge this obligation, the owner or occupant should give attention to the inspection, maintenance, and recharging of this fire-protective equipment and should also train personnel in the correct use of fire extinguishers on the different types of fires that could occur on the property.

The owner or occupant should recognize fire hazards on the property and plan in advance the exact means and equipment with which a fire will be fought. The owner/occupant should ensure that everyone knows how to call the fire department and stress that they do so for every fire, no matter how small.

On larger properties, a private fire brigade should be established and trained. Personnel need to be assigned to inspect each fire extinguisher periodically. Other personnel can have the duty of maintaining and recharging such equipment at scheduled intervals.

Portable fire extinguishers are appliances to be used principally by the occupants of a fire-endangered building or area who are familiar with the location and operation of the extinguisher through education or training. Portable fire extinguishers are primarily of value for immediate use on small fires. They have a limited quantity of extinguishing material and, therefore, need to be used properly so that this material is not wasted.

Fire extinguishers are mechanical devices. They need care and maintenance at periodic intervals to ensure that they are ready to operate properly and safely. Parts and internal chemicals can deteriorate with time and need replacement. They are pressure vessels, in most cases, and so need to be treated with respect and handled with care.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.3 Carbon Dioxide. Liquid carbon dioxide forms dry ice (“snow”) when released directly into the atmosphere. Carbon dioxide gas is 1½ times heavier than air. Carbon dioxide extinguishes fire by reducing the concentrations of oxygen, the vapor phase of the fuel, or both in the air to the point where combustion stops.

• **A.3.3.4.1 Dry Chemical.** European and ISO standards do not distinguish between dry chemical agents and dry powder agents. Their use of the term *dry powder* includes both dry chemical and dry powder as defined in this standard.

A.3.3.4.2 Wet Chemical. While loaded stream and wet chemical agent charges can comprise similar materials, their formulations could dictate differing maintenance procedures.

A.3.3.9 Dry Powder. See A.3.3.4.1.

A.3.3.10 Electronic Monitoring. Electronic monitoring can be accomplished utilizing low-voltage wiring or a wireless communication method. It can convey information about an in-place fire extinguisher that includes status, pressure level, presence, condition, and if there is an obstruction to the extinguisher.

Electronic monitoring can satisfy many of the monthly inspection requirements currently within the standard, monitor the extinguisher at more frequent intervals if desired or when more frequent inspections are required, and create an electronically maintained record of the fire extinguisher.

A.3.3.14 Extinguisher Inspection. It is intended to give reasonable assurance that the fire extinguisher is fully charged.

A.3.3.15 Extinguisher Maintenance. See A.7.3.2.

A.3.3.16 Film-Forming Foam Agents. AFFF and FFFP include both grades, which are those that are not approved for polar solvents (water-soluble flammable liquids) and those that are approved for polar solvents.

A.3.3.18 Halogenated Agents. Halon 1211 and Halon 1301 are included in the "Montreal Protocol on Substances that Deplete the Ozone Layer," signed September 16, 1987. In compliance with national regulations, production of halons ceased on January 1, 1994.

See NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, for more information on halocarbon agents.

A.3.3.20 Loaded Stream Charge. While loaded stream and wet chemical agent charges can comprise similar materials, their formulations could dictate different maintenance procedures.

A.3.4.2 Nonrechargeable (Nonrefillable) Fire Extinguisher. Nonrechargeable (nonrefillable) fire extinguishers are marked "Discharge and Dispose of After Any Use," "Discharge and Return to the Manufacturer After Any Use," or with a similar equivalent marking. Some fire extinguishers that are physically rechargeable are marked "nonrechargeable" and are therefore considered by this standard to be nonrechargeable (nonrefillable) fire extinguishers.

A.3.4.4 Rechargeable (Refillable) Fire Extinguisher. The fire extinguisher is capable of being recharged with agent and restored to its full operating capability by the standard practices used by fire equipment dealers and distributors. Rechargeable (refillable) fire extinguishers are marked "Recharge Immediately After Any Use" or with a similar equivalent marking.

A.4.1.2 Authorities having jurisdiction should determine the acceptability and credibility of the organization listing or labeling fire extinguishers. Authorities should determine if the organization tests to all the requirements of the standard. Factors such as the structure of the organization, its principal fields of endeavor, its reputation and established expertise, its involvement in the standards-writing process, and the extent of its follow-up service programs should all be assessed before recognition is given.

A.4.1.3 Authorities having jurisdiction should determine the thoroughness of the factory follow-up quality assurance program exercised by third-party certification organizations listing and labeling portable fire extinguishers. The specified factory follow-up standard provides a minimum basis for that determination. Application of the factory follow-up standard provides a reasonable assurance that portable fire extinguishers sold to the public continue to have the same structural reliability and performance as the fire extinguishers the manufacturer originally submitted to the listing and labeling organization for evaluation.

A.4.2 Federal OSHA regulations require that manufacturers communicate information as to the type of chemicals in a product that can be hazardous and the level of hazard. This information is contained in the MSDS created for each chemical or mixture of chemicals and is summarized on labels or tags attached to the product. Additionally, state and local authorities have enacted similar acts and regulations requiring identification of chemicals and hazardous ingredients in products. MSDSs for fire extinguisher agents are available on request from fire equipment dealers or distributors or the fire equipment manufacturer.

The identification of contents information enables determination of the type of chemicals contained in the fire extinguisher and helps to resolve complications arising from an unusual use of the agent. The HMIS (in Canada, the WHMIS) developed by the National Paint and Coatings Association uses a three-place format with numerical indexes from 0 to 4. The first place is for "toxic properties," the second place is for "flammability," and the third place is for "reactivity" with other chemicals. Most fire extinguishers have a 0 numerical index in the second and third places because they are nonflammable and relatively inert.

Information on the HMIS can be obtained from Label Master, Inc., in Chicago, IL, or from the National Paint and Coatings Association in Washington, DC. Extinguisher contents information can be integrated into the standard fire extinguisher label in some form, or it can be on a separate label or tag. The following example is a typical chemical contents identification marking:

CONTENTS:
ABC DRY CHEMICAL/HMIS 1-0-0 MUSCOVITE
MICA, MONOAMMONIUM PHOSPHATE
AMMONIUM SULFATE/NUISANCE DUST
IRRITANT/CONTENTS UNDER PRESSURE
[Manufacturer's Name, Mailing Address,
Phone Number]

A.4.3 The manual can be specific to the fire extinguisher involved, or it can cover many types.

A.4.4.1 The requirement in 4.4.1 brings the standard into line with the 1984 changes to UL 299, *Dry Chemical Fire Extinguishers*, and to UL 711, *Rating and Fire Testing of Fire Extinguishers*.

(1) *Hose*. The 1984 edition of UL 299 requires extinguishers rated 2A or higher or 20-B or higher to be equipped with a discharge hose. Before this change, almost all 5 lb extinguishers and many 10 lb extinguishers were equipped with a fixed nozzle on the outlet of the extinguisher valve and no hoses. These extinguishers, rated 2A to 4A and 10B to 60B are the ones used to comply with the installation requirements now contained in Chapter 6. To properly use one of these extinguishers, the user must keep it in the upright position, apply the dry chemical to the base of the fire, and sweep the discharge back and forth. The requirement for the addition of a hose to these extinguishers came out of the novice fire tests sponsored by Underwriters Laboratories (UL) and the Fire Equipment Manufacturers Association. The film footage of these tests shows that persons who had never used a fire extinguisher before often used both hands to operate these extinguishers, turning the extinguisher cylinder in a horizontal position while squeezing the handle and lever to open the valve. Sometimes they even inverted the extinguisher. The result of such actions is only a partial discharge of the extinguisher contents or possibly only the expellant gas and therefore no extinguishment of the fire. The addition of a hose also makes it much easier to direct the discharge at the base of the flames and to sweep the discharge from side to side. The requirement to add a hose makes it more likely that the extinguisher will be used in an

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upright position. In fact, it is almost impossible to do otherwise, since one hand opens the valve and the other hand, which holds the hose, directs the discharge stream to the fire. It is important to note that field modification of an extinguisher is generally not allowed since the modification might not have been evaluated to comply with the test requirements in the applicable UL extinguisher standards, and the extinguisher might not operate as intended. Thus, a fixed nozzle cannot simply be removed from an extinguisher and replaced with a hose and nozzle.

(2) *Minimum Discharge Time.* This requirement, found in the 1984 edition of UL 711, requires a minimum 13-second discharge duration for an extinguisher rated 2A or higher. The 13-second minimum requirement was the result of recommendations from the novice fire tests mentioned in A.4.4.1(1). Before 1984, almost all 2A-rated dry chemical extinguishers had discharge durations of only 8 to 10 seconds. The novice fire tests clearly showed that longer discharge duration resulted in an increased likelihood of extinguishment. The revision to UL 711 mandated a 50 percent to 60 percent increase in the minimum discharge duration for a 2A-rated dry chemical extinguisher. Modification of extinguishers with a nozzle/hose that gives different or longer discharge duration is not allowed. Such modification would not have been evaluated to comply with the test requirements in the applicable UL extinguisher standards, and the extinguisher might not operate as intended.

(3) *Pull Pins.* A revision to the extinguisher standards, including UL 299, required a maximum 30 lb of force to remove a safety pin or pull pin from an extinguisher. This again came from the novice testing, in which some individuals could not physically remove the pin and actuate the extinguisher. The UL extinguisher standards also included a design requirement so the pin is visible from the front of the extinguisher unless noted by the operating instructions.

(4) *Operating Instructions/Marking.* The extinguisher standards, including the 1984 revision of UL 299, mandated the use of pictographic operating instructions and code symbols on all but Class D extinguishers and wheeled extinguishers. These requirements also came out of the novice fire tests, which showed many individuals taking too long to read and understand the written operating instructions. The novice tests actually developed the pictographic operating instructions and tested them on novice operators for effectiveness. The details of the number of instructions per pictogram came from the test program. The novice fire test was also the impetus to making the use code symbols for the various classes of fires more understandable. The new pictographic use code symbols were also mandated in 1984 as well as a uniform method of applying A, B, and C symbols to extinguishers with ABC or BC only ratings. The result was a uniform, consistent set of easily understood symbols that made the extinguisher more user friendly.

(5) *Service Manuals.* The extinguisher standards, including UL 299, for the first time mandated that extinguisher manufacturers have a service manual for their products. In addition, the 1984 edition of UL 299 required a reference to the service/maintenance manual on the extinguisher nameplate. Prior to 1984, service manuals were not required.

A.5.3.2.1 Examples of extinguishers for protecting Class A hazards are as follows:

(1) Water type
(2) Halogenated agent type *(For halogenated agent–type fire extinguishers, see 5.3.2.6.)*
(3) Multipurpose dry chemical type
(4) Wet chemical type

A.5.3.2.2 Examples of extinguishers for protecting Class B hazards are as follows:

(1) Aqueous film-forming foam (AFFF)
(2) Film-forming fluoroprotein foam (FFFP)
(3) Carbon dioxide
(4) Dry chemical type
(5) Halogenated agent type *(For halogenated agent–type fire extinguishers, see 5.3.2.6.)*

A.5.3.2.3 The use of dry chemical fire extinguishers on wet energized electrical equipment (such as rain-soaked utility poles, high-voltage switch gear, and transformers) could aggravate electrical leakage problems. The dry chemical in combination with moisture provides an electrical path that can reduce the effectiveness of insulation protection. The removal of all traces of dry chemical from such equipment after extinguishment is recommended.

A.5.3.2.4 The following information pertains to Class D hazards:

(1) Chemical reaction between burning metals and many extinguishing agents (including water) can range from explosive to inconsequential, depending in part on the type, form, and quantity of metal involved. In general, the hazards from a metal fire are significantly increased when such extinguishing agents are applied. The advantages and limitations of a wide variety of commercially available metal fire extinguishing agents are discussed in Section 6, Chapter 26, of the NFPA *Fire Protection Handbook*. The MSDS of the Class D hazard being protected or the extinguisher manufacturer should be consulted.

(2) The agents and fire extinguishers discussed in this section are of specialized types, and their use often involves special techniques peculiar to a particular combustible metal. A given agent will not necessarily control or extinguish all metal fires. Some agents are valuable in working with several metals; others are useful in combating only one type of metal fire. The authorities having jurisdiction should be consulted in each case to determine the desired protection for the particular hazard involved.

(3) Certain combustible metals and reactive chemicals require special extinguishing agents or techniques. If there is doubt, applicable NFPA standards should be consulted or reference made to NFPA 49, *Hazardous Chemicals Data*, or NFPA 325, *Guide to Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids*. (Both NFPA 49 and NFPA 325 have been officially withdrawn from the *National Fire Codes*, but the information is still available in NFPA's *Fire Protection Guide to Hazardous Materials*.)

(4) Reference should be made to the manufacturer's recommendations for use and special techniques for extinguishing fires in various combustible metals.

(5) Fire of high intensity can occur in certain metals. Ignition is generally the result of frictional heating, exposure to moisture, or exposure from a fire in other combustible materials. The greatest hazard exists when these metals are in the molten state or in finely divided forms of dust, turnings, or shavings.

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The properties of a wide variety of combustible metals and the agents available for extinguishing fires in these metals are discussed in Section 4, Chapter 16, and Section 6, Chapter 26, of the NFPA *Fire Protection Handbook*.

A.5.3.2.6 Halon agent is highly effective for extinguishing fire and evaporates after use, leaving no residue. Halon agent is, however, included in the Montreal Protocol list of controlled substances developed under the United Nations Environment Program. Where agents other than halon can satisfactorily protect the hazard, they should be used instead of halon. Halon use should be limited to extinguishment of unwanted fire; it should not be used for routine training of personnel.

A.5.3.2.6.1 ANSI/UL 2129, *Standard for Halocarbon Clean Agent Fire Extinguishers*, and UL 1093, *Standard for Halogenated Agent Fire Extinguishers*, require halocarbon and halogenated agent nameplates to provide safety guidelines for avoiding overexposure to agent vapors when the agents are discharged into confined spaces. The UL minimum volume requirement for confined spaces is based on exposure to the agent in the absence of a fire and does not include considerations for fire or agent decomposition products.

A.5.3.2.7 Wheeled fire extinguishers are available in capacities of 33 gal (125 L) for foam units and range from 30 lb to 350 lb (13.6 kg to 158.8 kg) for other types of extinguishers. These fire extinguishers are capable of delivering higher agent flow rates and greater agent stream range than normal portable-type fire extinguishers. Wheeled fire extinguishers are capable of furnishing increased fire-extinguishing effectiveness for high hazard areas and have added importance where a limited number of people are available.

A.5.4.1.1 Light (low) hazard occupancies can include some buildings or rooms occupied as offices, classrooms, churches, assembly halls, guest room areas of hotels or motels, and so forth. This classification anticipates that the majority of content items are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammables used for duplicating machines, art departments, and so forth, are included, provided that they are kept in closed containers and safely stored.

A.5.4.1.2 Ordinary (moderate) hazard occupancies could consist of dining areas, mercantile shops and allied storage, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of light (low) hazard occupancies, and warehouses containing Class I or Class II commodities as defined by NFPA 13, *Standard for the Installation of Sprinkler Systems.*

A Class I commodity is defined by NFPA 13 as a noncombustible product that meets one of the following criteria:

(1) Is placed directly on wooden pallets
(2) Is placed in single-layer corrugated cartons, with or without single-thickness cardboard dividers, with or without pallets
(3) Is shrink-wrapped or paper-wrapped as a unit load, with or without pallets

A Class II commodity is defined by NFPA 13 as a noncombustible product that is in slatted wooden crates, solid wood boxes, multiple-layered corrugated cartons, or equivalent combustible packaging material, with or without pallets.

A.5.4.1.3 Extra (high) hazard occupancies could consist of woodworking; vehicle repair; aircraft and boat servicing; cooking areas; individual product display showrooms; product convention center displays; and storage and manufacturing processes such as painting, dipping, and coating, including flammable liquid handling. Also included is warehousing or in-process storage of other than Class I and Class II commodities.

A.5.4.2 Most buildings have Class A fire hazards. In any occupancy, there could be a predominant hazard as well as special hazard areas requiring supplemental protection. For example, a hospital will generally have need for Class A fire extinguishers covering patients' rooms, corridors, offices, and so forth, but will need Class B fire extinguishers in laboratories and where flammable anesthetics are stored or handled, Class C fire extinguishers in electrical switch gear or generator rooms, and Class K extinguishers in kitchens.

A.5.4.2.2 If fire extinguishers intended for different classes of fires are grouped, their intended use should be marked conspicuously to aid in the choice of the proper fire extinguisher at the time of a fire. In an emergency, the tendency is to reach for the closest fire extinguisher. If this fire extinguisher is of the wrong type, users could endanger themselves and the property they are endeavoring to protect. Wherever possible, it is preferable to have only those fire extinguishers available that can be safely used on any type of fire in the immediate vicinity.

A.5.5.1.1 Pressurized flammable liquids and pressurized gas fires are considered to be a special hazard. Class B fire extinguishers containing agents other than dry chemical are relatively ineffective on this type of hazard due to stream and agent characteristics. The system used to rate the effectiveness of fire extinguishers on Class B fires (flammable liquids in depth) is not applicable to these types of hazards. It has been determined that special nozzle design and rates of agent application are required to cope with such hazards.

A.5.5.1.1.2 A three-dimensional Class B fire involves Class B materials in motion, such as pouring, running, or dripping flammable liquids, and generally includes vertical as well as one or more, horizontal surfaces. Fires of this nature are considered to be a special hazard. The system used to rate fire extinguishers on Class B fires (flammable liquids in depth) is not directly applicable to this type of hazard. The installation of fixed systems should be considered where applicable.

A.5.5.4(2) Where multiple extinguishers are utilized, simultaneous discharge from multiple locations to eliminate any blind spots created by an obstacle should be employed.

A.5.5.5 Fire extinguishers for cooking media (vegetable or animal oils and fats) traditionally followed Table 6.3.1.1 for extra (high) hazard, requiring a minimum 40-B rated sodium bicarbonate or potassium bicarbonate dry chemical extinguisher. The evolution of high-efficiency cooking appliances and the change to hotter-burning vegetable shortening has created a more severe fire hazard. Testing has shown that wet chemical extinguishers have several times the cooking fire–extinguishing capability of a minimum 40-B rated sodium bicarbonate or potassium bicarbonate dry chemical extinguisher, which has prompted the creation of a new classification and a new listing test protocol. The test protocol is found in ANSI/UL 711, *Standard for Rating and Fire Testing of Fire Extinguishers*.

See NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, for further information. Persons in cooking areas need specific training on the use of extinguishers as an essential step for personal safety. Class K fire extinguishers equipped with extended wand–type discharge devices should not be used in a manner that results in subsurface injection of wet chemical extinguishing agents into hot cooking media. Subsurface injection causes a thermodynamic reaction comparable to an explosion. Class K fire extinguishers are no longer manufactured with extended wand–type discharge devices.

A.5.5.5.3 Figure A.5.5.5.3(a) and Figure A.5.5.5.3(b) show the recommended wording for the Class K placard. Recommended size is 7⅝ in. × 11 in. (193 mm × 279 mm).

A.5.5.6 Delicate electronic equipment includes, but is not limited to, data processing, computers, CAD, CAM, robotics, and reproduction equipment. Use of fire extinguishers containing other extinguishing agents can damage beyond repair both the equipment at the source of the fire and related equipment in the immediate vicinity of the fire.

A.5.5.6.1 Dry chemical residue will probably not be able to be completely and immediately removed, and, in addition, multipurpose dry chemical exposed to temperatures in excess of 250°F (121°C) or relative humidity in excess of 50 percent can cause corrosion.

A.6.1.1 The following items affect distribution of portable fire extinguishers:

(1) Area and arrangement of the building occupancy conditions
(2) Severity of the hazard
(3) Anticipated classes of fire
(4) Other protective systems or devices
(5) Distances to be traveled to reach fire extinguishers

In addition, the following factors should be considered:

(1) Anticipated rate of fire spread
(2) Intensity and rate of heat development
(3) Smoke contributed by the burning materials
(4) Accessibility of a fire to close approach with portable fire extinguishers

Wheeled fire extinguishers have additional agent and range and should be considered for areas where the additional protection is needed. Portable fire extinguishers offer the occupant a means to assist in evacuation of a building or occupancy. They are useful to knock down the fire if it occurs along the evacuation route. If possible, the individual property should be surveyed for actual protection requirements.

A.6.1.3.3.2 Acceptable means of identifying the fire extinguisher locations include arrows, lights, signs, or coding of the wall or column.

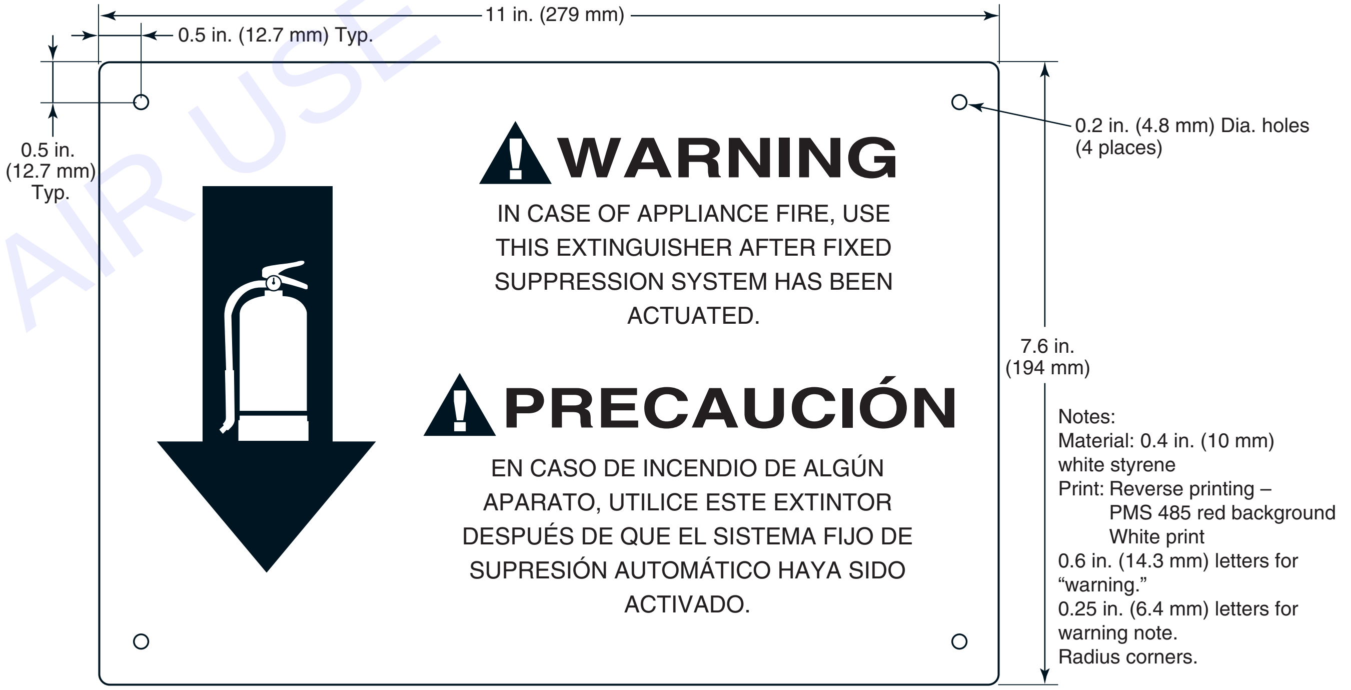
A.6.1.3.4 In situations where it is necessary that fire extinguishers be provided temporarily, a good practice is to provide portable stands, consisting of a horizontal bar on uprights with feet, on which the fire extinguishers can be hung.

A.6.1.3.10.4 Vented fire extinguisher cabinets should utilize tinted glass and should be constructed to prevent the entrance of insects and the accumulation of water. Vented fire extinguisher cabinets constructed in this manner lower the maximum internal temperature 10°F to 15°F (5.6°C to 8.3°C).

A.6.1.3.11 The following precautions should be noted where fire extinguishers are located in areas that have temperatures outside the range of 40°F to 120°F (4°C to 49°C):

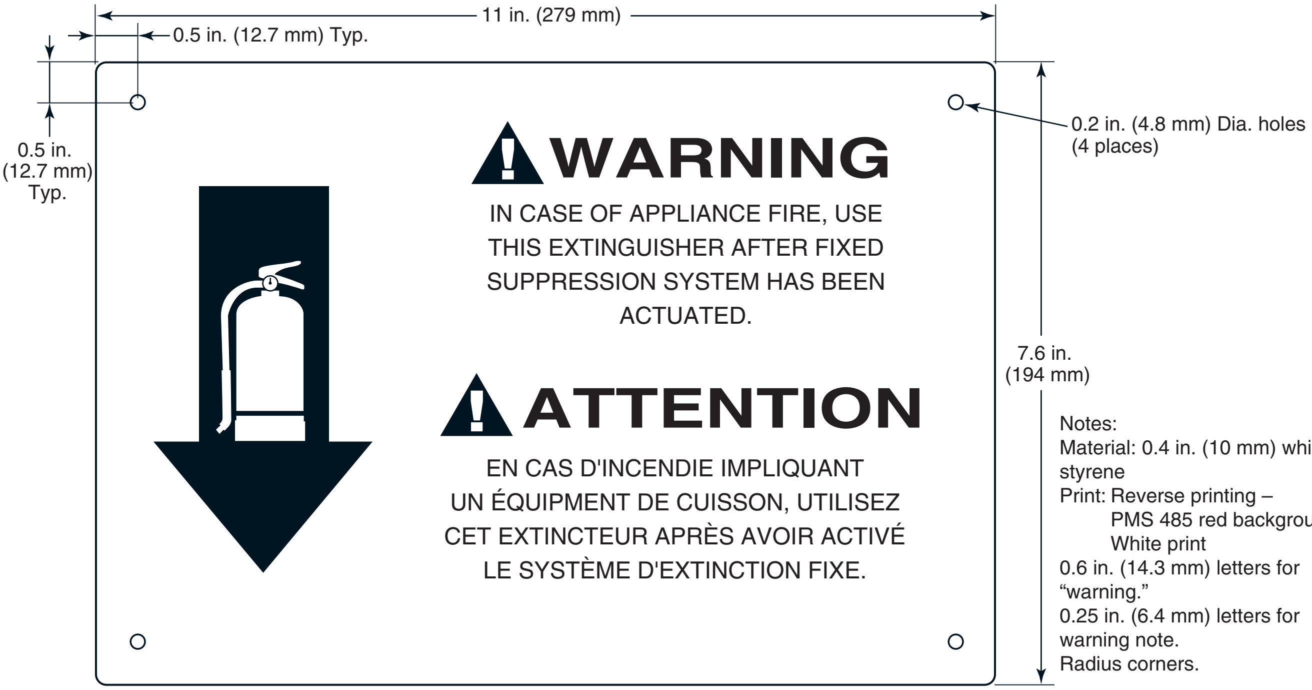
(1) AFFF and FFFP fire extinguishers cannot be protected against temperatures below 40°F (4°C) by adding an antifreeze charge because it tends to destroy the effectiveness of the extinguishing agent.

FAIR USE


11 in. (279 mm)
0.5 in. (12.7 mm) Typ.
0.5 in. (12.7 mm) Typ.
0.2 in. (4.8 mm) Dia. holes (4 places)
7.6 in. (194 mm)
WARNING
IN CASE OF APPLIANCE FIRE, USE THIS EXTINGUISHER AFTER FIXED SUPPRESSION SYSTEM HAS BEEN ACTUATED.
PRECAUCIÓN
EN CASO DE INCENDIO DE ALGÚN APARATO, UTILICE ESTE EXTINTOR DESPUÉS DE QUE EL SISTEMA FIJO DE SUPRESIÓN AUTOMÁTICO HAYA SIDO ACTIVADO.

Notes:
Material: 0.4 in. (10 mm) white styrene
Print: Reverse printing –
PMS 485 red background
White print
0.6 in. (14.3 mm) letters for "warning."
0.25 in. (6.4 mm) letters for warning note.
Radius corners.

FIGURE A.5.5.5.3(a) Typical Class K Placard in English and Spanish.


11 in. (279 mm)
0.5 in. (12.7 mm) Typ.
0.5 in. (12.7 mm) Typ.
0.2 in. (4.8 mm) Dia. holes (4 places)
7.6 in. (194 mm)
WARNING
IN CASE OF APPLIANCE FIRE, USE THIS EXTINGUISHER AFTER FIXED SUPPRESSION SYSTEM HAS BEEN ACTUATED.
ATTENTION
EN CAS D'INCENDIE IMPLIQUANT UN ÉQUIPMENT DE CUISSON, UTILISEZ CET EXTINCTEUR APRÈS AVOIR ACTIVÉ LE SYSTÈME D'EXTINCTION FIXE.

Notes:
Material: 0.4 in. (10 mm) white styrene
Print: Reverse printing –
PMS 485 red background
White print
0.6 in. (14.3 mm) letters for "warning."
0.25 in. (6.4 mm) letters for warning note.
Radius corners.

FIGURE A.5.5.5.3(b) Typical Class K Placard in English and French.

(2) Plain water fire extinguishers should not be protected against temperatures below 40°F (4°C) with ethylene glycol antifreeze. Calcium chloride solutions should not be used in stainless steel fire extinguishers.
(3) Fire extinguishers installed in machinery compartments, diesel locomotives, automotive equipment, marine engine compartments, and hot processing facilities can easily be subjected to temperatures above 120°F (49°C). Selection of fire extinguishers for hazard areas with temperatures above the listed limits should be made on the basis of recommendations by manufacturers of this equipment.

A.6.3.2.2 Where such personnel are not available, the hazard should be protected by fixed systems.

A.6.4 Electrical equipment should be de-energized as soon as possible to prevent reignition.

A.7.1 This chapter is concerned with the rules governing inspection, maintenance, and recharging of fire extinguishers. These factors are of prime importance in ensuring operation at the time of a fire. The procedure for inspection and maintenance of fire extinguishers varies considerably. Minimal knowledge is necessary to perform a monthly "quick check" or inspection in order to follow the inspection procedure as outlined in Section 7.2.

A.7.1.2.1 Persons performing maintenance and recharging of extinguishers should meet one of the following criteria:

(1) Factory training and certification for the specific type and brand of portable fire extinguisher being serviced
(2) Certification by an organization acceptable to the authority having jurisdiction
(3) Registration, licensure, or certification by a state or a local authority having jurisdiction

Certification confirms that a person has fulfilled specific requirements as a fire extinguisher service technician and has earned the certification. For the purpose of this standard, certification is the process of an organization issuing a document confirming that an applicant has passed a test based on the chapters and annexes of this standard. The organization administering the test issues an official document that is relied upon as proof of passing the test. Ultimately, the document issued by the organization administering the test must be acceptable to the authority having jurisdiction. Some authorities having jurisdiction do not rely on outside organizations and establish their own local licensing programs that include a test.

A.7.1.2.1.2 Industrial facilities that establish their own maintenance and recharge facilities and that provide training to personnel who perform these functions are considered to be in compliance with this requirement. Examples include power generation, petrochemical, and telecommunications facilities. A letter from the facility management can be used as the certification document.

A.7.1.2.3 This is not intended to prevent service technicians from performing the 30-day inspections.

A.7.2.1.1 Frequency of fire extinguisher inspections should be based on the need of the area in which fire extinguishers are located. The required monthly inspection is a minimum.

A.7.2.1.2 Inspections are performed on extinguishers 12 times per year, once per month.

A.7.2.1.3 Inspections should be more frequent if any of the following conditions exists:

(1) High frequency of fires in the past
(2) Severe hazards

FAIR USE

(3) Susceptibility to tampering, vandalism, or malicious mischief
(4) Possibility of or history of theft of fire extinguishers
(5) Locations that make fire extinguishers susceptible to mechanical injury
(6) Possibility of visible or physical obstructions
(7) Exposure to abnormal temperatures or corrosive atmospheres
(8) Characteristics of fire extinguishers, such as susceptibility to leakage

More frequent inspections could be enhanced through electronic monitoring of the fire extinguisher.

A.7.3 Persons performing maintenance operations usually come from two major groups:

(1) Fire extinguisher service agencies
(2) Trained industrial safety or maintenance personnel

Fire extinguishers owned by individuals are often neglected because a periodic follow-up program is not planned. It is recommended that such owners become familiar with their fire extinguishers so they can detect telltale warnings during inspection that suggest the need for maintenance. When maintenance is indicated, it should be performed by trained persons having proper equipment. *(See 7.1.2.2.)*

The purpose of a well-planned and well-executed maintenance program for a fire extinguisher is to maximize the following probabilities:

(1) That the extinguisher will operate properly between the time intervals established for maintenance examinations in the environment to which it is exposed
(2) That the extinguisher will not constitute a potential hazard to persons in its vicinity or to operators or rechargers of fire extinguishers

Any replacement parts needed should be obtained from the manufacturer or a representative.

A.7.3.1.2.1.2 Halon removed from a fire extinguisher is kept in a closed recovery/recharge system until disposition can be made as to whether to recharge the halon back into a fire extinguisher or return unsatisfactory halon to a manufacturer for proper disposal. A listed Halon 1211 closed recovery/recharge system has the following:

(1) Clear sight glass for monitoring the cleanliness of the Halon 1211
(2) A means of determining if the acceptable water content of the halon has been exceeded
(3) A means of mechanically filtering the Halon 1211 and removing excess water

Such a recovery system also has a motor-driven pump system that permits the transfer of halon into a fire extinguisher or supply container without the need to vent the receiving container to reduce its pressure before halon transfer. Closed recovery/recharge systems also include the plumbing, valves, regulators, and safety relief devices to permit convenient, quick transfer of the Halon 1211.

FAIR USE

A.7.3.1.3 Carbon dioxide hose assemblies have a continuous metal braid that connects to both couplings to minimize the static shock hazard. The reason for the conductivity test is to determine that the hose is conductive from the inlet coupling to the outlet orifice. A basic conductivity tester consists of a flashlight having an open circuit and a set of two wires with a conductor (clamps or probe) at each end.

Figure A.7.3.1.3 provides a guide to the design of a conductivity test label.

CONDUCTIVITY TESTED
2006 DISTRIBUTION NAME 2008
Dist. license no. ____________________
2007 Employee name ____________________ 2009
Employee lic. no. ____________________
Jan/Feb/March/April/May/June/July/Aug/Sept/Oct/Nov/Dec

FIGURE A.7.3.1.3 Conductivity Test Label.

A.7.3.1.5 The following procedure permits rapid removal of the hose by one person without kinking of the hose and without obstruction of flow of the extinguishing agent:

(1) Form a loop over hose supports *[see Figure A.7.3.1.5(a)]*.
(2) Follow with a reverse loop so that hose passes behind loop *[see Figure A.7.3.1.5(b)]*.
(3) Repeat steps (1) and (2) until all hose is coiled on the support *[see Figure A.7.3.1.5(c)]*.
(4) Adjust the coil so that the nozzle is in the downward position *[see Figure A.7.3.1.5(d)]*. Hose coiled in this manner pulls off free of twists.
(5) Place nozzle in holder with handle forward in the closed position *[see Figure A.7.3.1.5(e)]*.

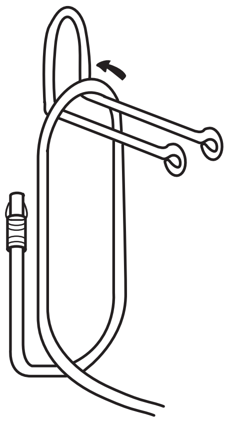


FIGURE A.7.3.1.5(a) Counterclockwise Loop.

A.7.3.2 The annual maintenance of a fire extinguisher requires the services of a trained and certified technician who has the proper tools, listed parts, and appropriate manufacturer's service manual. Maintenance of fire extinguishers should not be confused with inspection, which is a quick check of the extinguishers that is performed at least every 30 days. Because the detailed maintenance procedures for various extinguisher types and models differ, the specific procedures specified within service manuals need to be followed.

The following list is a sample of maintenance procedures and checks that are commonly associated with rechargeable, stored-pressure dry chemical hand portable fire extinguishers:

(1) Remove the extinguisher from hanger, bracket, or cabinet and visually examine it for damage.
(2) Verify that the hanger, bracket, or cabinet is the proper one for the extinguisher.

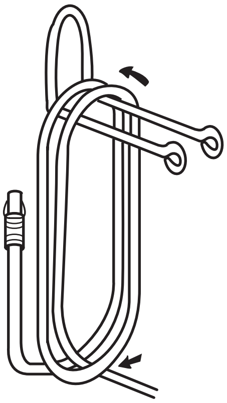


FIGURE A.7.3.1.5(b) Reverse Loop.

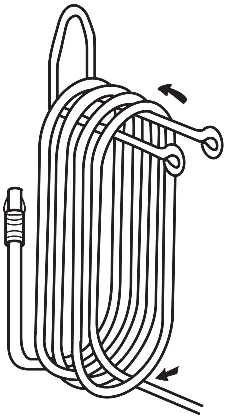


FIGURE A.7.3.1.5(c) Procedures in Figure A.7.3.1.5(a) and Figure A.7.3.1.5(b) Continued.

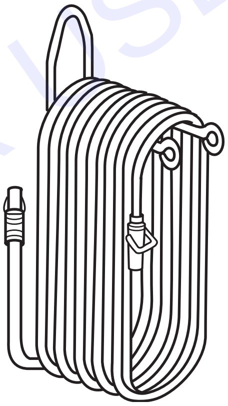


FIGURE A.7.3.1.5(d) Nozzle in Downward Position.

(3) Ensure that the hanger, bracket, or cabinet is secure, undamaged, and properly mounted.
(4) Ensure that the nameplate operating instructions are legible and facing outward.
(5) Confirm that the extinguisher model is not subject to recall and is not obsolete.

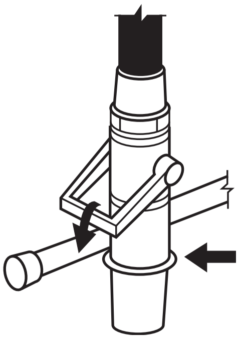


FIGURE A.7.3.1.5(e) Nozzle in Holder.

(6) Check extinguisher records to determine internal examination and hydrostatic test intervals.
(7) Thoroughly examine cylinder for dents, damage, repairs, or corrosion.
(8) Remove the pull pin to ensure that it functions properly and is not damaged or corroded.
(9) Examine the handle and levers to ensure that they are undamaged and operable.
(10) Ensure that the valve stem is correctly extended and not corroded or damaged.
(11) Verify that the pressure gauge or indicator is in the operable range.
(12) Examine the pressure gauge to ensure that it is not damaged, bent, or cracked.
(13) Verify that the gauge-operating pressure corresponds with the nameplate instructions.
(14) Verify that the gauge face corresponds with the proper agent type.
(15) Verify that the gauge threads are compatible with the valve body material.
(16) Remove the nozzle or hose assembly or both and ensure that they are unobstructed.
(17) Confirm that the nozzle and hose assembly are correct for the model of extinguisher.
(18) Examine exposed thread areas for corrosion, wear, or damage.
(19) Ensure that the hose and couplings are not cut, cracked, damaged, or deformed.
(20) Examine internal valve port surfaces and threads for signs of leakage or corrosion.
(21) Reinstall the nozzle and hose assembly securely.
(22) Ensure that the hose retention band is secure and properly adjusted.
(23) Weigh the extinguisher to verify that it corresponds to the weight listed on the nameplate.
(24) Reinstall the ring pin and install a new tamper inspection seal.
(25) Clean exposed extinguisher surfaces to remove any foreign material.
(26) Record the maintenance on the extinguisher tag or label.
(27) Return the extinguisher to the hanger, bracket, or cabinet.

A.7.3.2(5) Certain fire extinguisher electronic monitoring devices require annual maintenance, such as replacement of the primary or alternate battery or batteries. See specific manufacturers' maintenance recommendations.

FAIR USE

A.7.3.2.2 Where a safety seal or tamper indicator is missing, it can be evidence that the fire extinguisher has been used and therefore should be removed from service. Extreme caution should be exercised before replacing a tamper seal on a nonrechargeable fire extinguisher.

A.7.3.2.3 Removable extinguisher boots and foot rings are those that are not put on by the extinguisher manufacturer with glue or welded.

A.7.3.3 In addition to the required tag or label, a permanent file record should be kept for each fire extinguisher. This file record should include the following information, as applicable:

(1) Maintenance date and the name of the person and the agency performing the maintenance
(2) Date of the last recharge and the name of the person and the agency performing the recharge
(3) Hydrostatic retest date and the name of the person and the agency performing the hydrostatic test
(4) Description of dents remaining after passing of the hydrostatic test
(5) Date of the 6-year maintenance for stored-pressure dry chemical and halogenated agent types *(See 7.3.1.2.2.)*

It is recognized that an electronic bar coding system is often acceptable to the authority having jurisdiction in lieu of a tag or label for maintenance record keeping.

Under special circumstances or when local requirements are in effect, additional information can be desirable or required.

A.7.3.3.1 Labels should be printed in black with a light blue background.

A.7.3.3.2 A number of states have regulations requiring an internal marking of an extinguisher that is used to verify if the extinguisher has been depressurized, if the valve has been removed, and if a complete maintenance has been performed. The verification-of-service collar design also requires that the valve be removed before the collar can be attached to the extinguisher. The collar provides the authorities having jurisdiction with a more convenient visual proof that the extinguisher has been disassembled and that maintenance has been performed.

This standard does not specifically require a verification-of-service collar when a hydrostatic test is performed on a fire extinguisher cylinder. All extinguishers are to have the valve removed for hydrostatic testing and are to be subsequently recharged before they are returned to service. To be valid, the date on the verification-of-service collar should always be the same as or more recent than the date on the hydrostatic test label.

Figure A.7.3.3.2 provides a guide to the design of a verification-of-service collar.

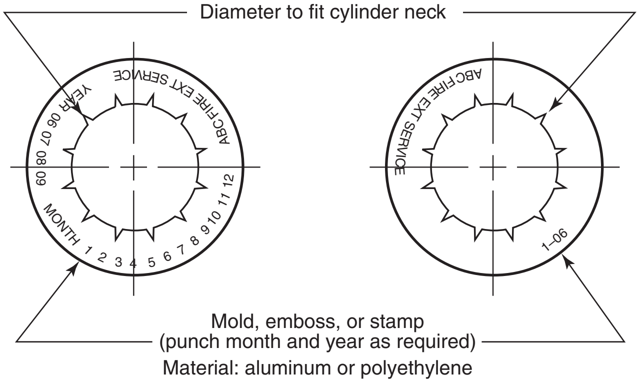

Diameter to fit cylinder neck
YEAR 06 07 08 09
ABC FIRE EXT SERVICE
MONTH 1 2 3 4 5 6 7 8 9 10 11 12
ABC FIRE EXT SERVICE
1–06
Mold, emboss, or stamp
(punch month and year as required)
Material: aluminum or polyethylene

FIGURE A.7.3.3.2 Design of a Verification-of-Service Collar.

A.7.4.1 General safety guidelines for recharging include the following:

(1) Make sure all pressure is vented from the fire extinguisher before attempting to remove the valve body or to fill the closure. (**Warning:** Do not depend on pressure-indicating devices to tell if the container is under pressure, because the devices could malfunction.)
(2) Use proper recharge materials when refilling a fire extinguisher. Mixing of some extinguishing agents can cause a chemical reaction, resulting in a dangerous pressure buildup in the container.
(3) The weight of agent as specified on the nameplate is critical. Overfilling could render the fire extinguisher dangerous or ineffective.
(4) Clean and properly lubricate all sealing components to prevent leakage after recharge.
(5) Check pressure-indicating device to ascertain that it is reading properly.
(6) Most manufacturers recommend the use of dry nitrogen as an expellant gas for stored-pressure fire extinguishers. Limiting charging pressure regulator setting to 25 psi (172 kPa) above service pressure, as 7.4.4.2, prevents gauge damage and loss of calibration. (**Warning:** Never connect the fire extinguisher to be charged directly to the high-pressure source. Connecting directly to the high-pressure source could cause the container to rupture, resulting in injury. Never leave a fire extinguisher connected to the regulator of a high-pressure source for an extended period of time. A defective regulator could cause the container to rupture due to excess pressure.)
(7) Use the manufacturer's recommended charging adapter to prevent damage to a valve and its components.
(8) When recharging separate expellant source fire extinguishers, make sure the filled enclosure is in place and tightened down. Replace all safety devices prior to installing replacement cartridges.
(9) Use only gas cartridges recommended by the manufacturer. Cartridge features such as pressure relief, puncturing capabilities, fill density, and thread compatibility are designed and approved to specific functional requirements.
(10) Use proper safety seals; other types, such as meter seals, could fail to break at the prescribed requirements.
(11) Regulators utilized on wheeled fire extinguishers are factory pinned at the operating pressure and should not be field adjusted.

A.7.4.1.2 Some manufacturers require that their fire extinguishers be returned to the factory for recharging.

A.7.4.1.3 To determine the gross weight, the entire fire extinguisher should be weighed empty. The weight of the specified recharge agent should be added to that amount.

A.7.4.1.3.5 The leak test required for stored-pressure and self-expelling types should be sufficiently sensitive to ensure that the fire extinguisher remains operable for at least 1 year. Any tamper indicators or seals need to be replaced after recharging.

FAIR USE

A.7.4.3.1 On properties where fire extinguishers are maintained by the occupant, a supply of recharging agents should be kept on hand. These agents should meet the requirements of 7.4.3.1.

The intent of this provision is to maintain the efficiency of each fire extinguisher as produced by the manufacturer and as labeled by one or more of the fire testing laboratories. For example, the extinguishing agent and the additives used in the various types of dry chemical fire extinguishers vary in chemical composition and in particle size and, thus, in flow characteristics. Each fire extinguisher is designed to secure maximum efficiency with the particular formulation used. Changing the agent from that specified on the fire extinguisher nameplate could affect flow rates, nozzle discharge characteristics, and the quantity of available agent (as influenced by density) and would void the label of the testing laboratory.

Certain recharging materials deteriorate with age, exposure to excessive temperature, and exposure to moisture. Storage of recharge agents for long periods of time should be avoided.

Dry powder used for combustible metal fires (Class D) should not become damp, because the powder will not be free flowing. In addition, when dry powder contains sufficient moisture, a hazardous reaction could result when applied to a metal fire.

A.7.4.3.2 Mixing multipurpose dry chemicals with alkaline-based dry chemicals could result in a chemical reaction capable of developing sufficient pressures to rupture a fire extinguisher. Substituting a different formulation for the one originally employed could cause malfunctioning of the fire extinguisher or result in substandard performance.

A.7.4.3.6 Moisture within a non-water-type fire extinguisher creates a serious corrosion hazard to the fire extinguisher shell and also indicates what is probably an inoperative fire extinguisher. Moisture could possibly enter at the following times:

(1) After a hydrostatic test
(2) When recharging is being performed
(3) When the valve has been removed from the cylinder
(4) Where compressed air and a moisture trap are used for pressurizing non-water types

FAIR USE

It is extremely important to remove any water or moisture from any fire extinguisher before recharging. Excess moisture in a dry chemical fire extinguisher causes the agent to cake and lump and become unusable. It also causes corrosion to the fire extinguisher shell and valve. In carbon dioxide and halogenated fire extinguishers, excess moisture combined with the extinguishing agent causes extremely corrosive acids to form. These acids can corrode the fire extinguisher shell and valve.

A.7.4.3.7 If the fire extinguisher valve is removed for servicing, it is recommended that the fire extinguisher be purged with nitrogen or argon (as appropriate) or that a vacuum be drawn on the fire extinguisher cylinder prior to recharging.

A.7.4.3.9 The preferred source of carbon dioxide for recharging fire extinguishers is from a low-pressure [300 psi at 0°F (2068 kPa at –17.8°C)] supply, supplied either directly or via dry cylinders used as an intermediary means. Dry ice converters should not to be used to recharge carbon dioxide portable fire extinguishers.

A.7.4.3.10 When stored-pressure fire extinguishers are recharged, overfilling results in improper discharge.

A.7.4.4.1 If it becomes necessary to replace a pressure gauge on a fire extinguisher, in addition to knowing the charging pressure, it is important to know the type of extinguishing agent for which the gauge is suitable, as well as the valve body with which the gauge is compatible. This information often is available in the form of markings on the dial face. Where the marking is provided, the extinguishing agent is indicated by references such as "Use Dry Chemicals Only," while the valve body compatibility is indicated as follows:

(1) Gauges intended for use with aluminum or plastic valve bodies are marked with a line above the gauge manufacturer's code letter.
(2) Gauges intended for use with brass or plastic valve bodies are marked with a line below the manufacturer's code letter.
(3) Universal gauges that can be used with aluminum, brass, or plastic valve bodies are marked with lines above and below the manufacturer's code letter or by the absence of any line above or below the manufacturer's code letter.

Using the proper replacement gauge as to pressure range, extinguishing agent, and valve body compatibility is recommended to avoid or to reduce gauge-related problems.

A.7.4.4.2.3 A defective regulator could cause the container to rupture due to excess pressure.

A.7.4.4.3.5 Some Class D fire extinguishers are required to be pressurized with argon.

A.8.1.2.1.3 It is acceptable for hydrostatic testing to be subcontracted to persons or facilities that are qualified to perform such work and that have the required equipment and personnel trained in hydrostatic testing procedures and safeguards. The task of hydrostatic testing is only part of the work involved. The extinguisher must be depressurized, emptied, and disassembled and have the valve disassembled, cleaned, and refurbished as necessary. Materials such as extinguisher manufacturers' service manuals, service bulletins, parts, and lubricants should be available. After the hydrostatic testing, the extinguisher must be refilled, reassembled, pressurized, and leak tested. These are all tasks involved in "other" extinguisher servicing and must be accomplished by someone who is qualified as an extinguisher service technician.

A.8.1.5 The structural integrity of aluminum shells and cylinders is reduced when they are exposed to temperatures in excess of 350°F (177°C). These temperatures can occur under fire exposure without any visual evidence or during repainting operations in which oven drying is utilized.

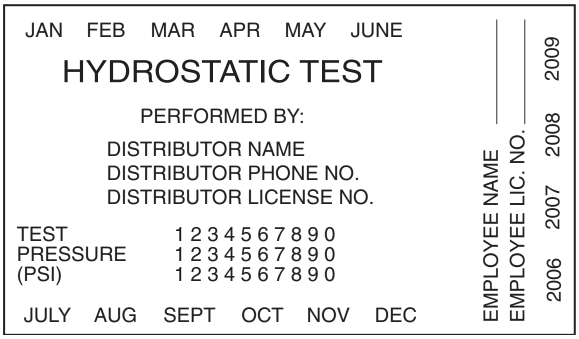
A.8.2 This standard permits hydrostatic testing only of pressure vessels used as fire extinguishers and specified components of fire extinguishers.

A.8.4.2 A condemned cylinder or fire extinguisher can be destroyed only by its owner or at the owner's direction. It is strongly recommended that a record be kept of cylinders or fire extinguishers that are recommended to be destroyed.

A.8.4.2(1) For welding or brazing on mild steel shells, consult the manufacturer of the fire extinguisher.

A.8.7.1 A record of testing should include, as a minimum, the date of the test, cylinder serial number or extinguisher serial number, model number, cylinder size, test pressure, visual inspection result, cylinder disposition, and initials of person performing the test. Refer to CGA C-1, *Methods of Hydrostatic Testing of Compressed Gas Cylinders,* for a sample form for recording test results.

A.8.7.2 Figure A.8.7.2 provides a guide to the design of a hydrostatic test label. All print should be black on a silver background.



JAN FEB MAR APR MAY JUNE

HYDROSTATIC TEST

PERFORMED BY:

DISTRIBUTOR NAME
DISTRIBUTOR PHONE NO.
DISTRIBUTOR LICENSE NO.

TEST PRESSURE (PSI) 1 2 3 4 5 6 7 8 9 0
1 2 3 4 5 6 7 8 9 0
1 2 3 4 5 6 7 8 9 0

JULY AUG SEPT OCT NOV DEC

EMPLOYEE NAME ________
EMPLOYEE LIC. NO. ________

2006 2007 2008 2009

FIGURE A.8.7.2 Design of a Hydrostatic Test Label.

Annex B Recommended Markings to Indicate Extinguisher Suitability According to Class of Fire

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 General.

B.1.1 Markings should be applied by decals that are durable and resistant to color fading *(see Figure B.1.1)*. The color separation identification for the markings is as follows:

(1) Picture symbol objects are white.
(2) Background borders are white.
(3) Background for "YES" symbols is blue.
(4) Background for symbols with slash mark ("NO") is black.
(5) Class of fire letters and wording is black.
(6) Slash mark for black background symbols is red.

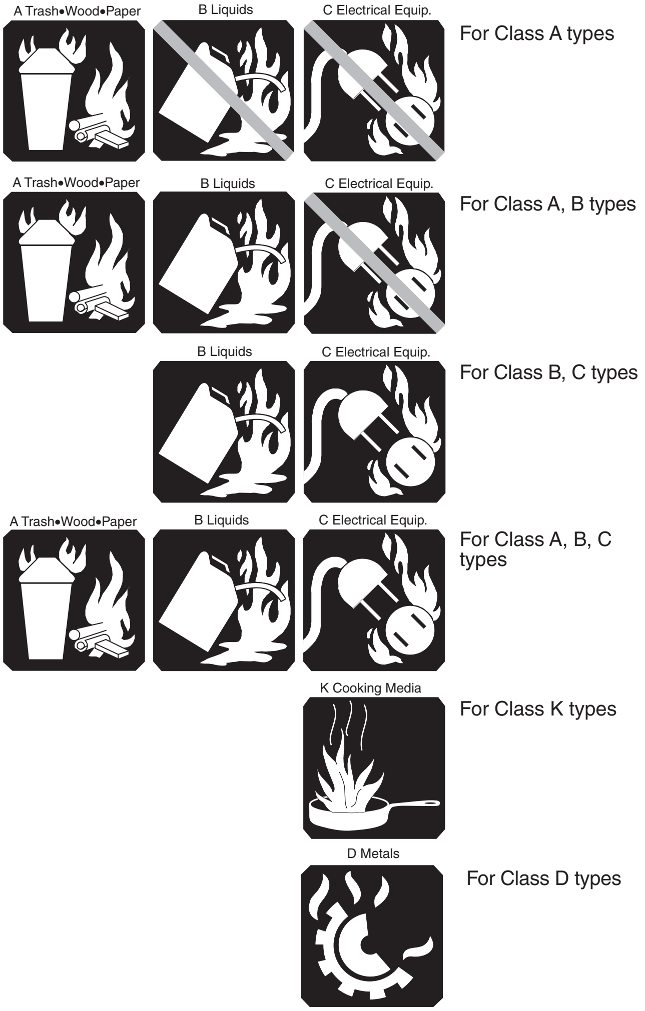
B.1.2 Markings should be located on the front of the fire extinguisher shell. Size and form should permit easy legibility at a distance of 3 ft (1 m). The labels shown in Figure B.1.1 are consistent with fire extinguishers that have been tested and listed in accordance with fire test standards. *(See 5.4.1.3.)*

B.1.3 Where markings are applied to wall panels, and so forth, in the vicinity of fire extinguishers, they should permit easy legibility at a distance of 15 ft (4.6 m).

B.2 Recommended Marking System.

B.2.1 The recommended marking system is a pictorial concept that combines the uses and nonuses of fire extinguishers on a single label. *(See Figure B.1.1.)*

B.2.2 Letter-shaped symbol markings, as previously recommended, are shown in Figure B.2.2. Note that fire extinguishers suitable for more than one class of fire should be identified by multiple symbols placed in a horizontal sequence.



Note: Recommended colors, per PMS (Pantone Matching System) include the following:

BLUE — 299
RED — Warm Red

FIGURE B.1.1 Recommended Marking System.

Annex C Fire Extinguisher Selection

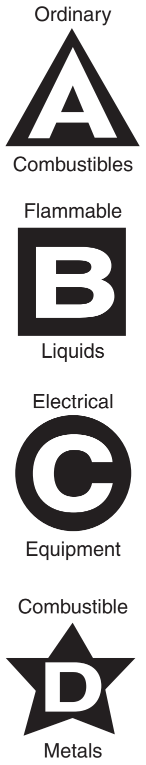
This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Principles of Selecting Fire Extinguishers.

C.1.1 Selection of the best portable fire extinguisher for a given situation depends on the following factors:

(1) Nature of the combustibles or flammables that could be ignited
(2) Potential severity (size, intensity, and speed of travel) of any resulting fire
(3) Effectiveness of the fire extinguisher on that hazard
(4) Ease of use of the fire extinguisher
(5) Personnel available to operate the fire extinguisher and their physical abilities and emotional reactions as influenced by their training

FAIR USE



Extinguishers suitable for Class A fires should be identified by a triangle containing the letter “A.” If colored, the triangle is colored green.*

Extinguishers suitable for Class B fires should be identified by a square containing the letter “B.” If colored, the square is colored red.*

Extinguishers suitable for Class C fires should be identified by a circle containing the letter “C.” If colored, the circle is colored blue.*

Extinguishers suitable for fires involving metals should be identified by a five-pointed star containing the letter “D.” If colored, the star is colored yellow.*

* Recommended colors, per PMS (Pantone Matching System) include the following:

GREEN — Basic Green
RED — 192 Red
BLUE — Process Blue
YELLOW — Basic Yellow

FIGURE B.2.2 Letter-Shaped Symbol Markings.

FAIR USE

(6) Ambient temperature conditions and other special atmospheric considerations (wind, draft, presence of fumes)
(7) Suitability of the fire extinguisher for its environment
(8) Any anticipated adverse chemical reactions between the extinguishing agent and the burning materials
(9) Any health and operational safety concerns (exposure of operators during the fire control efforts)
(10) Upkeep and maintenance requirements for the fire extinguisher

C.1.2 Portable fire extinguishers are designed to cope with fires of limited size and are necessary and desirable even if the property is equipped with automatic sprinkler protection, standpipe and hose systems, or other fixed fire-protective equipment.

C.1.3 A fire creates conditions of stress and intense excitement. Under these conditions, the choice of a correct fire extinguisher needs to be made quickly. The protection planner can help to ensure selection of the correct fire extinguisher by using the following procedures:

(1) Locating the fire extinguishers near fire hazards for which they are suitable
(2) Using fire extinguishers suitable for more than one class of fire
(3) Marking clearly the intended use *(See Annex B.)*
(4) Training employees in the use of proper fire extinguishers

The use of conspicuous markings to readily identify a fire extinguisher’s suitability is particularly important where fire extinguishers are grouped or where multiple fire hazards are present in an area.

C.2 Matching Fire Extinguishers to the Hazard.

C.2.1 The first step in evaluating the selection of a fire extinguisher for the protection of a property is to determine the nature of the materials that might be ignited. Some fire extinguishers are suitable for only one class of fire, others for two, and still others for three. For example, a plain water fire extinguisher is suitable for Class A fires only.

C.2.2 The successful use of a Class A fire extinguisher on an incipient fire is directly related to the quantity of combustible material (contents and interior finish or both) involved. The amount of combustibles is sometimes referred to as the *fire loading* of a building, figured as the average pounds of combustibles per square foot of area. The larger the amount of combustibles, the greater the fire loading and the greater the potential fire hazard that the fire extinguisher could be called upon to combat. Based on this concept, Class A fire extinguishers are allocated according to the average fire loading that could be encountered in the occupancy to be protected.

C.2.3 Virtually every structure, even if of fire-resistive or noncombustible construction, has some combustible building components in the form of interior finish, partitions, and so forth. Thus, for building protection, fire extinguishers suitable for Class A fires are standard. Likewise, in virtually every situation, whether it be a building, a vehicle, or an outdoor exposure, ordinary combustible materials are found.

C.2.4 It is also true that, where ordinary combustibles are present, there could be the need for fire extinguishers suitable for use on Class B and Class C fires (e.g., in the dining areas of a restaurant, the principal combustibles present are wood, paper, and fabrics, which are Class A materials; however, in the kitchen area, the essential hazard involves combustible cooking oils, and a Class K fire extinguisher should be installed).

C.2.5 As another example, although in hospitals there is a general need for Class A fire extinguishers to cover spaces such as the patients’ rooms, corridors, offices, and so forth, Class B:C fire extinguishers should be available in the laboratories, in areas where flammable anesthetics are stored or handled, and in electrical switchgear or generator rooms. Each area should be surveyed for its actual fire extinguisher requirements, keeping in mind the variety of conditions that exist in that particular area. Class K fire extinguishers should be installed in kitchen areas where cooking oils and fats are used.

C.2.6 Class B flammable liquids and gases typically burn in one or more of the following five basic configurations:

(1) Spill fires, which are uncontained horizontal liquid fuel situations
(2) Fuel-in-depth fires, which are liquid fuels having depths greater than ¼ in. (6.3 mm)
(3) Obstacle fires, which are fuel situations completely surrounding a sizable object
(4) Gravity/three-dimensional fires, which are pouring, running, or dripping fuel situations
(5) Pressure fires, which are forced, pumped, or sprayed fuel situations

Each of the five Class B fire burning configurations can present significantly different extinguishment requirements that can affect the selection of extinguishing agent and hardware, as well as the necessary application technique utilized. Variations between indoor and outdoor conditions can present additional complications affecting the necessary discharge range.

C.2.6.1 Class B spill fire situations are typically capable of being handled by most Class B–rated fire extinguishers, given the proper discharge range is considered and the necessary unit size is properly matched to the fire hazard. Extinguishment can be affected by variations in fuel properties and ventilation or wind conditions. Table 6.3.1.1 provides some specific minimum Class B fire extinguisher recommendations for occupancies.

C.2.6.2 Class B fuel-in-depth or appreciable depth fire situations are those having liquid fuel depths greater than ¼ in. (6.3 mm), which normally occur within contained areas such as collection pans, solvent dipping operations, and industrial quench tanks. The selection of an extinguishing agent and hardware should be made on the basis of the fuel properties and total surface area involved. Subsection 6.3.2 provides guidance for occupancies. The method used to rate Class B fire extinguishers is based on the square foot surface area of test pans containing a minimum of 2 in. (51 mm) of heptane fuel and can be a useful reference. These fire situations can be complicated or intensified if the fuel is splashed by the improper application of the extinguishing agent.

C.2.6.3 Class B obstacle fire situations present some additional extinguisher agent, hardware, and application considerations. AFFF and FFFP foam portable extinguishers are capable of extinguishing and securing horizontal flammable liquid situations by suppressing combustible vapors and often the best selection for obstacle fire hazard situations when only one application point might be anticipated at the time of a fire. Nonsecuring or nonvapor suppressing types of Class B extinguishing agents can often only be successfully utilized when they are applied simultaneously from multiple locations to eliminate any blind spot presented by an obstacle. Special nonsecuring agent types of fire extinguishers that have higher agent discharge flow rates sufficient to effectively wrap around an obstacle can also successfully accomplish extinguishment. The system used to rate Class B fire extinguishers is not applicable to these types of fire hazard situations. The selection of extinguishers for these hazards should be made on the basis of the equipment manufacturer's recommendations.

C.2.6.4 Class B gravity/three-dimensional fire situations present special extinguisher agent, hardware, and application considerations. Because the burning fuel is moving, Class B foam agents cannot successfully extinguish these situations. The potential size of these fires often dictates the best agent and effective discharge characteristics necessary. The application of an extinguishing agent onto gravity-fed types of fires is usually best accomplished when extinguishment is started at the bottom or lowest level and then worked upward. The system used to rate Class B fire extinguishers is not applicable to these types of fire hazard situations. The selection of extinguishers for these hazards should be made on the basis of the equipment manufacturer's recommendations.

C.2.6.5 Class B pressure fire situations present special extinguishing agent, hardware, and application considerations. Class B fire extinguishers containing agents other than the small, solid dry chemical particles are relatively ineffective on any sizable type of pressure fire situation. Special extinguisher nozzle designs and agent discharge flow rates that meet or exceed the minimum critical application thresholds of a particular fuel are necessary. The application of an extinguishing agent onto pressure fire situations is usually best accomplished when the discharge of agent is injected at an approximate angle between 15 to 45 degrees through the source of the fuel and working the flame outward, effectively wiping the flame off the fuel. The system used to rate Class B fire extinguishers is not applicable to these types of fire hazard situations. The selection of extinguishers for these hazards should be made on the basis of the equipment manufacturer's recommendations.

> **CAUTION:** It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be shut off promptly.

C.2.7 The Class B ratings given by testing laboratories are based on flammable liquid fires of appreciable depth. The number thus derived is an approximate indication of the relative fire-extinguishing potential of the fire extinguisher.

C.2.8 The selection of Class B fire extinguishers to be used on pressurized flammable liquids and pressurized gas fires requires special consideration. Fires of this nature are considered to be a special hazard, and only dry chemical types of fire extinguishers should be employed. Other types of Class B–rated fire extinguishers are relatively ineffective on these hazards. It has been determined that special dry chemical nozzle designs and rates of application are required to cope with such hazards.

> **CAUTION:** It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be shut off promptly.

C.2.9 The size and type of the Class C fire extinguisher selected should be based on the following:

(1) Construction features of the electrical equipment
(2) Degree of agent contamination that can be tolerated
(3) Size and extent of Class A and Class B components, or both, that are a part of the equipment
(4) Nature and amount of combustible materials in the immediate vicinity (e.g., large motors and power panels contain a considerable amount of Class A insulating materials as compared to the Class B material in an oil-filled transformer)

C.2.10 Once an analysis is made of the nature of the combustibles present and their potential fire severity, a study is made of the various candidate fire extinguishers that could be provided to meet fire protection needs.

C.2.11 Class D combustible metal fires typically involve various forms of combustible metal powders, flakes, shavings, chips, or liquid states that burn at extremely high temperatures, capable of breaking down normal extinguishing agents to cause an undesirable reaction. Only extinguishing agents specifically tested and listed for use on particular combustible Class D metal fire hazards should be selected and provided. Appropriate protection is typically established utilizing a hazard-to-agent ratio recommendation established through testing. The selection of fire extinguishers for these hazards should be made on the basis of equipment manufacturers' recommendations.

C.2.12 Class K combustible cooking media fires typically involve kitchen appliances containing quantities of cooking greases or oils that present special hazard extinguishment and re-flash concerns. Only extinguishing agents having the ability to saponify and create a thick, heavy, long-lasting type of foam blanket upon the hot cooking media surface seal out the oxygen, cool the cooking media, and keep these fire situations out. The Class K listed fire extinguishers have effectively demonstrated the ability to address these commercial kitchen types of fire hazard situations.

C.3 Selecting the Right Fire Extinguisher.

C.3.1 Selecting the right fire extinguisher for the class of hazard depends on a careful analysis of the advantages and disadvantages (under various conditions) of the various types available. The following paragraphs review some of the points that should be considered.

C.3.2 Water-Type Fire Extinguishers.

C.3.2.1 The most popular type is the 2½ gal (9.46 L) stored-pressure water fire extinguisher. These fire extinguishers are being used to replace inverting types of water fire extinguishers (soda acid and cartridge-operated water), which are no longer manufactured. An important advantage of the stored-pressure water type, as opposed to the inverting type, is its ability to be discharged intermittently. Some models are suitable for use at freezing conditions when charged as specified on the nameplate.

C.3.2.2 Since the pump tank fire extinguisher (hand-carry type) cannot be operated while being carried, it is considered somewhat more difficult to use. However, it does possess some advantages over stored-pressure types under certain applications. It is an excellent choice for use as a standby fire extinguisher on welding or cutting operations, protecting buildings in remote locations, and for use by the construction industry. It can easily be filled from any convenient, relatively clean water supply, can be used without the need for pressurization, and can be easily maintained. For freezing conditions, chemical additives containing corrosion inhibitors can be used; however, copper and nonmetallic tank models are recommended because they do not corrode easily. The backpack style of pump tank, which can be carried and operated at the same time, is ideally suited for use in combating brush fires.

FAIR USE

C.3.3 AFFF and FFFP Fire Extinguishers. AFFF (aqueous film-forming foam) and FFFP (film-forming fluoroprotein) fire extinguishers are rated for use on both Class A and Class B fires. They are not suitable for use in freezing temperatures. An advantage of this type of extinguisher when used on Class B flammable liquid fires of appreciable depth is the ability of the agent to float on and secure the liquid surface, which helps to prevent reignition.

C.3.4 Carbon Dioxide (CO_2) Fire Extinguishers. The principal advantage of CO_2 fire extinguishers is that the agent does not leave a residue after use. This can be a significant factor where protection is needed for delicate and costly electronic equipment. Other typical applications are food preparation areas, laboratories, and printing or duplicating areas. Carbon dioxide extinguishers are listed for use on Class B and Class C fires. Because the agent is discharged in the form of a gas/snow cloud, it has a relatively short range of 3 ft to 8 ft (1 m to 2.4 m). This type of fire extinguisher is not recommended for outdoor use where windy conditions prevail or for indoor use in locations that are subject to strong air currents, because the agent can rapidly dissipate and prevent extinguishment. The concentration needed for fire extinguishment reduces the amount of oxygen (air) needed for life safety when the discharge is in a confined area (space).

C.3.5 Halogenated Agent Extinguishers.

C.3.5.1 The bromochlorodifluoromethane (Halon 1211) fire extinguisher has an agent that is similar to carbon dioxide in that it is suitable for cold weather installation and leaves no residue. Some larger models of Halon 1211 fire extinguishers are listed for use on Class A as well as Class B and Class C fires. Compared to carbon dioxide on a weight-of-agent basis, bromochlorodifluoromethane (Halon 1211) is at least twice as effective. When discharged, the agent is in the combined form of a gas/mist with about twice the range of carbon dioxide. To some extent, windy conditions or strong air currents could make extinguishment difficult by causing the rapid dispersal of the agent.

C.3.5.2 In general, bromotrifluoromethane (Halon 1301) fire extinguishers have features and characteristics similar to those of carbon dioxide fire extinguishers in that they are suitable for cold weather installation and leave no residue. Halon 1301 fire extinguishers are listed for Class B and Class C fires. Compared to carbon dioxide on a weight-of-agent basis, bromotrifluoromethane (Halon 1301) is at least as effective. When discharged, the agent is in the combined form of a gas/mist. To some extent, windy conditions or strong air currents could make extinguishment difficult by causing the rapid dispersal of the agent.

C.3.5.3 Fire extinguishers containing a mixture of Halon 1211 and Halon 1301 share properties of the other halogenated agent–type fire extinguishers, such as leaving no residue after use and minimizing thermal shock. The mixture of halogenated agents discharges in the form of a gas/mist, with the ratio of gas to mist increasing with higher ratios of Halon 1301 to Halon 1211. The discharge range likewise is affected by the ratio of Halon 1301 to Halon 1211, with the range decreasing as the proportion of Halon 1301 increases. To some extent, windy conditions or strong air currents could make extinguishment difficult by causing the rapid dispersal of the agent.

C.3.5.4 Halocarbon agents are similar to halon agents in that they are nonconductive, noncorrosive, and evaporate after use, leaving no residue. Larger models of halocarbon fire extinguishers are listed for Class A as well as Class B and Class C fires, which makes them quite suitable for use on fires in electronic equipment. Compared to carbon dioxide on a weight-of-agent basis, halocarbon agents are at least twice as effective. When discharged, these agents are in the combined form of a gas/mist or a liquid, which rapidly evaporates quickly after discharge with about twice the range of carbon dioxide. To some extent, windy conditions or strong air currents could make extinguishing difficult by causing a rapid dispersal of agent.

C.3.6 Dry Chemical Extinguishers.

C.3.6.1 Due to the different designs and the various types of dry chemical agents, choosing the most suitable dry chemical fire extinguisher requires careful evaluation. Hand portable models have a discharge stream that ranges from 10 ft to 30 ft (3 m to 9 m), depending on fire extinguisher size. Compared with carbon dioxide or halogenated agent fire extinguishers, they also perform better under windy conditions.

C.3.6.2 Dry chemical fire extinguishers are available in two basic styles: stored-pressure and cartridge-operated. The stored-pressure (rechargeable) type is the most widely used and is best suited where infrequent use is anticipated and where skilled personnel with professional recharge equipment are available. The cartridge-operated type has the advantage of being quickly refilled in remote locations without the need for special equipment. Some dry chemical models can be equipped with long-range (high-velocity) nozzles or applicators that are beneficial in applying the agent under certain special fire-fighting conditions.

C.3.6.3 There are five available types of dry chemical agent, and each has certain advantages and disadvantages. These advantages and disadvantages should be reviewed by potential users.

C.3.6.4 The potassium and urea-potassium base bicarbonate agents are selected in preference to sodium bicarbonate, principally because of their greater fire-extinguishing capabilities. If corrosion is not a factor, potassium chloride can also be included in this group. However, the potassium chloride base agent is corrosive and does not have any specific extinguishing characteristics that are superior to the potassium bicarbonate base agents.

C.3.6.5 The ammonium phosphate base agent (multipurpose) is the only dry chemical agent that is suitable for Class A protection. In addition to Class B and Class C protection, the residues of multipurpose dry chemical, when left in contact with metal surfaces, can cause corrosion.

C.3.6.6 Where dry chemical fire extinguishers are utilized for Class C protection, it is important to consider that the residue of potassium chloride is more corrosive than other dry chemicals and that a multipurpose base agent is more difficult to remove because it first softens when in contact with hot surfaces and then hardens when it cools. Any of the other dry chemical agents, depending on protection requirements, could prove to be a more practical choice for Class C protection.

C.3.7 Wheeled Fire Extinguishers.

C.3.7.1 The selection of any type of wheeled fire extinguisher is generally associated with a recognized need to provide additional protection for special hazards or large, extra hazard areas. Where wheeled fire extinguishers are to be installed, consideration should be given to mobility within the area in which they will be used.

C.3.7.2 For outdoor locations, models with rubber tires or wide-rim wheels are easier to transport. For indoor locations, doorways, aisles, and corridors need to be wide enough to permit the ready passage of the fire extinguisher. Because of the magnitude of the fire it will generally be used on, this type of fire extinguisher should be reserved for use by operators who have actually used the equipment, who have received special instructions on the use of the equipment, or who have used the equipment in live fire training. *[See Figure C.3.7.2(a) and Figure C.3.7.2(b).]*

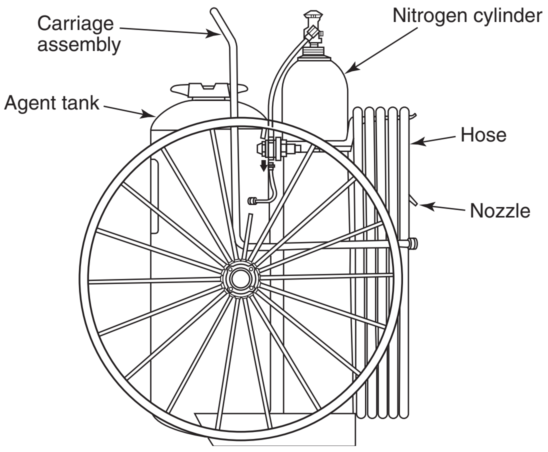


FIGURE C.3.7.2(a) Cylinder-Operated Dry Chemical Type.

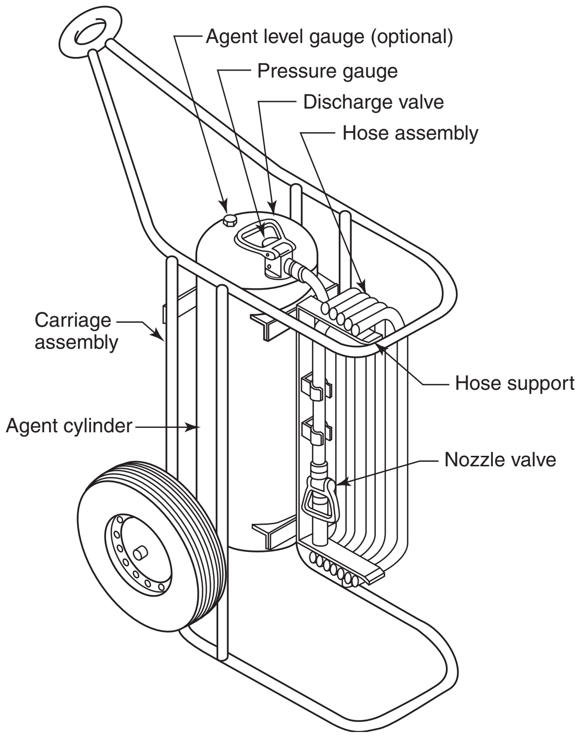


FIGURE C.3.7.2(b) Stored-Pressure Halogenated Agent Type.

Annex D Operation and Use

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

D.1 General.

D.1.1 Persons who are expected to use a fire extinguisher should be made familiar with all information contained in the manufacturer's nameplate(s) and the instruction manual. Proper operation of a fire extinguisher requires the operator to execute several basic steps in a certain sequence. The fire extinguisher designer, the approval agencies, the installer, and the protection planner can influence significantly the ease and likelihood of these steps being accomplished properly.

D.1.1.1 Fire extinguishers will be used by one or more of the following groups of people, listed in descending order of their probable skill:

(1) Trained fire departments (municipal or industrial)
(2) Trained or untrained employees (business or industrial)
(3) Untrained private owners (home, car, boat, etc.)
(4) Untrained general public

D.1.1.2 Where employees have not been trained, operation of fire extinguishers could be seriously delayed, the extinguishing material could be wasted due to poor application techniques, and more fire extinguishers could have to be used, or the fire could possibly not be extinguished.

D.1.1.3 It is not enough for the protection planner to determine the hazard of a location or area within a building and then select a proper type and size of fire extinguisher to fit the hazard. The planner needs to take into account any problems of getting the fire extinguisher into action and the difficulty of properly applying the extinguishing agent. The planner should also consider who is the most likely to use the fire extinguisher and should estimate the degree of skill or training that person should have.

D.1.2 Methods of Fire Extinguisher Operation.

D.1.2.1 The methods of operation of fire extinguishers are most conveniently arranged by grouping fire extinguishers according to their expelling means. Five methods in common use are as follows:

(1) *Self-expelling,* where the agents have sufficient vapor pressure at normal operating temperatures to expel themselves
(2) *Gas cartridge or cylinder,* where expellant gas is confined in a separate pressure vessel until an operator releases it to pressurize the fire extinguisher shell
(3) *Stored-pressure,* where the extinguishing material and expellant are kept in a single container
(4) *Mechanically pumped,* where the operator provides expelling energy by means of a pump and the vessel containing the agent is not pressurized
(5) *Hand-propelled,* where the material is applied with a scoop, pail, or bucket

D.1.2.2 Several different extinguishing materials are handled by each of these expelling means. Table D.1.2.2 lists the agent and expelling means combinations that are or have been in use.

D.2 Basic Steps to Operate Extinguishers.

D.2.1 The following are the basic steps necessary to put a fire extinguisher into operation:

(1) Recognition of a device as a fire extinguisher
(2) Selection and suitability of a fire extinguisher
(3) Transport of a fire extinguisher to the fire
(4) Actuation of the fire extinguisher
(5) Application of the extinguishing agent to the fire

D.2.2 Recognition of a Device as an Extinguisher.

D.2.2.1 Approval agencies require permanent marking on the front of fire extinguishers indicating their purpose, content, and usage.

D.2.2.2 Additional markings that are not part of device could be needed to indicate the location of a fire extinguisher. These preferably should be standardized throughout the property so that all fire extinguishers are easily "spotted." These markings could be in the form of electric lights, placards, mounting boards, overhead signs, color panels or stripes, or cabinets. They could be distinctively colored by painting or reflective taping.

D.2.2.3 If fire extinguishers are located along the normal exit paths from an area, personnel are more inclined to take them and return to the site of a fire.

D.2.3 Transport of a Fire Extinguisher to the Fire.

D.2.3.1 A fire extinguisher should be mounted and located so it can be easily removed in a fire emergency and brought to the site of the fire as quickly as possible. It should be readily accessible without need for moving or climbing over stock, materials, or equipment.

D.2.3.2 Portability is affected by the following factors:

(1) Weight of the fire extinguisher
(2) Travel distance to a possible fire
(3) Need for carrying the unit up or down stairs or ladders
(4) Need for using gloves
(5) Overall congestion of the premises
(6) Physical ability of the operators

D.2.3.3 In the case of wheeled fire extinguishers, the width of aisles and doorways and the nature of the flooring and outside grounds over which the fire extinguisher needs to be moved should be taken into account.

Table D.1.2.2 Extinguisher Operation and Methods of Expelling

	Expelling Methods				
Extinguishing Materials	**Self-Expelling**	**Gas Cartridge or Cylinder**	**Stored Pressure**	**Mechanically Pumped**	**Hand Propelled**
Water and antifreeze			x	x	x
Wetting agent			x		
AFFF and FFFP		x	x		
Loaded stream		x	x		
Multipurpose dry chemical		x	x		
Carbon dioxide	x				
Dry chemical		x	x		
Halogenated agents	x		x		
Dry powder (metal fires)		x	x		x
Wet chemical			x		

FAIR USE

D.2.4 Actuation of the Fire Extinguisher.

D.2.4.1 Once the fire extinguisher has been transported to the fire site, it should be placed into operation without delay. Employees should be familiar with any steps needed to actuate any fire extinguisher. Here is where previous training is most valuable, since there is little time to stop and read operating instructions on the nameplate.

D.2.4.2 To actuate a fire extinguisher, one or more of the following steps are required:

(1) *Position for Operation.* The intended position for operation is usually marked on the fire extinguisher. When the position of operation is obvious (such as when one hand holds the fire extinguisher and the other hand holds the nozzle), this information can be omitted.
(2) *Removal of Restraining or Locking Devices.* Many fire extinguishers have an operation safeguard or locking device that prevents accidental actuation. The most common device is a lock pin or ring pin that needs to be withdrawn before operation. Other forms of such devices are clips, cams, levers, or hose or nozzle restrainers. Most tamper indicators (such as wire and lead seals) break with removal of the restraining device. On some fire extinguishers, the restraining device is arranged to disengage when the unit is normally handled. No separate motion is required. This type of restraining device is especially suited for use by private owners and the general public since prior instruction is seldom possible.
(3) *Start of Discharge.* This requires one or more of several actions such as turning or squeezing a valve handle or lever, pushing a lever, or pumping. These actions can cause a gas to be generated, release a gas from a separate container, open a normally closed valve, or create a pressure within the container.
(4) *Agent Application.* This act involves directing the stream of extinguishing agent onto the fire. Nameplate information has advisory notes regarding the application of the agent to different types of fires. Specific application techniques are described in Section D.3.

FAIR USE

D.2.5 Expellant Gas/Pressure.

D.2.5.1 Many of the fire extinguishers described in this annex are of the stored-pressure or cartridge-operated type. Since the operating characteristics of these two types are similar, regardless of agent used, they are described generally in the following paragraphs.

D.2.5.2 In stored-pressure models, the expellant gas and extinguishing agent are stored in a single chamber, and the discharge is controlled by a shutoff valve or nozzle.

D.2.5.3 In cartridge-operated models, the expellant gas is stored in a separate cartridge or could be stored in an expellant-gas cylinder (wheeled models) located within or adjacent to the shell containing the extinguishing agent. These fire extinguishers are actuated by releasing the expellant gas that expels the agent. In most models, the discharge can subsequently be controlled by a shutoff valve or nozzle.

D.3 Application Techniques.

D.3.1 General.

D.3.1.1 Many fire extinguishers deliver their entire quantity of extinguishing material in 8 to 10 seconds (although some take 30 seconds or longer to discharge). The agent needs to be applied correctly at the outset since there is seldom time for experimentation. In many fire extinguishers, the discharge can be started or stopped by a valve. When some fire extinguishers are used on flammable liquid fires, the fire could flare up momentarily when the agent is initially applied.

D.3.1.2 The best technique of applying the fire extinguisher discharge on a fire varies with the type of extinguishing material.

D.4 Fire Extinguisher Characteristics.

D.4.1 Water Types. These types of extinguishers include water, antifreeze, wetting agent, and loaded stream fire extinguishers. Water-type fire extinguishers are intended primarily for use on Class A fires. The stream initially should be directed at the base of the flames. After extinguishment of flames, the stream should be directed generally at smoldering or glowing surfaces. Application should begin as close as possible to the fire. Deep-seated fires should be thoroughly soaked and might need to be "broken apart" to effect complete extinguishment.

D.4.1.1 Stored-Pressure Water. Hand fire extinguishers of this type are usually available in 2½ gal (9.46 L) capacity with a fire extinguishment rating of 2-A. Since the agent used is fresh water, this fire extinguisher cannot be installed in areas subjected to temperatures below 40°F (4°C). This same type of fire extinguisher is also manufactured in an antifreeze model charged with an approved solution that affords protection to temperatures as low as −40°F (−40°C). The fire extinguisher weighs about 30 lb (14 kg) and has a solid stream range of approximately 35 ft to 40 ft (10.7 m to 12.2 m) horizontally. This fire extinguisher can be operated intermittently, but under continuous use it has a discharge time of about 55 seconds. The operating lever is held in a locked position to prevent accidental discharge while being carried. Most manufacturers use a ring pin that needs to be pulled out before the operating lever can be depressed. To do this, it is best for the operator to set the fire extinguisher on the ground and, while loosely holding the combination handle in one hand, pull out the ring pin (or release a small latch) with the other hand. The operator then would grasp the hose and nozzle in one hand and squeeze the discharge lever with the other. *(See Figure D.4.1.1.)*

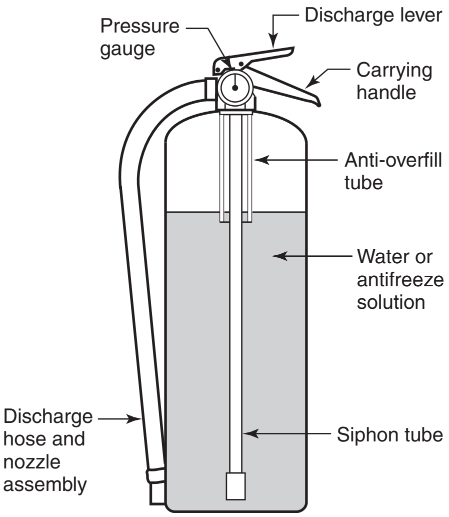


FIGURE D.4.1.1 Stored-Pressure Water Extinguisher.

D.4.1.2 Loaded Stream. Hand fire extinguishers of this type have been made with liquid capacities from 1 gal to 2½ gal (3.8 L to 9.46 L) having fire-extinguishing ratings of 1-A:1-B to 3-A:1-B. Due to limited effectiveness, these fire extinguishers are no longer recognized (listed) for use on Class B fires. Wheeled fire extinguishers have been made having liquid capacities of 17 gal and 33 gal (64 L and 125 L) [trade designations 20 gal and 40 gal (76 L and 151 L)] having fire extinguishment ratings of 10-A to 20-A. The chemical used is a solution of an alkali metal salt that does not freeze at temperatures as low as −40°F (−40°C).

D.4.1.3 Pump Tank. Fire extinguishers of this type have been made in 1½ gal to 5 gal (5.7 L to 19 L) capacities with fire extinguishment ratings of 1-A to 4-A. The most common type is 2½ gal (9.46 L), rated at 2-A. These fire extinguishers have cylindrical metal containers and carrying handles. In some models, the carrying handle is combined with the pump handle, and in others it is attached to the container. A built-in, hand-operated vertical piston pump, to which a short rubber hose and nozzle are attached, provides the means for discharging the water onto the fire. The pump is of the double-acting type, which discharges a stream of water on both the up and the down strokes. When brought to a fire, the pump tank is placed on the ground, and to steady the unit, the operator puts one foot on a small extension bracket attached to the base. To force the water through the hose, the operator then pumps the handle up and down. To work around the fire or to move closer to the fire as the flames subside, the operator needs to stop pumping and carry the fire extinguisher to a new location. The force, range, and duration of the stream are dependent, to a degree, on the operator.

Pump tank fire extinguishers can be filled with either plain water or antifreeze charges recommended by the fire extinguisher manufacturer. Common salt or other freezing depressants could corrode the fire extinguisher, damage the pump assembly, or affect the fire-extinguishing capability. Copper shell and nonmetallic models do not corrode as easily as steel and are recommended for use in conjunction with antifreeze agents. *(See Figure D.4.1.3.)*

FAIR USE

D.4.1.4 Backpack. This type of pump fire extinguisher is used primarily for fighting outdoor fires in brush and wildlands. The tank has a capacity of 5 gal (19 L) and weighs approximately 50 lb (23 kg) when full. Although it is listed by UL, it does not have a designated rating. Generally, plain water is used as the extinguishant. However, antifreeze agents, wetting agents, or other special water-base agents can be used. The tank can be constructed of fiberglass, stainless steel, galvanized steel, or brass. As its name implies, it is designed to be carried on the operator's back. The backpack fire extinguisher has a large opening for fast refilling as well as a tight-fitting filter to prevent foreign material from entering and clogging the pump. This design permits convenient refilling from nearby water sources such as ponds, lakes, or streams. The most commonly used model has a trombone-type, double-acting piston pump connected to the tank by a short length of rubber hose. Discharge occurs when the operator, holding the pump in both hands, moves the piston section back and forth. Other models have compression pumps mounted on the right side of the tank. Expellant pressure is built up with about 10 strokes of the handle and then maintained by continual slow, easy pumping strokes. Discharge is controlled with the left hand by means of a lever-operated shutoff nozzle attached to the end of the hose. *(See Figure D.4.1.4.)*

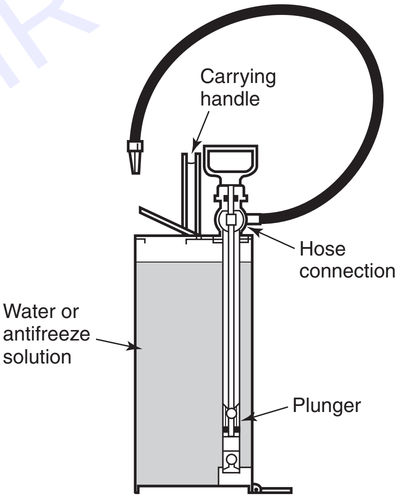


FIGURE D.4.1.3 Pump Tank Fire Extinguisher.

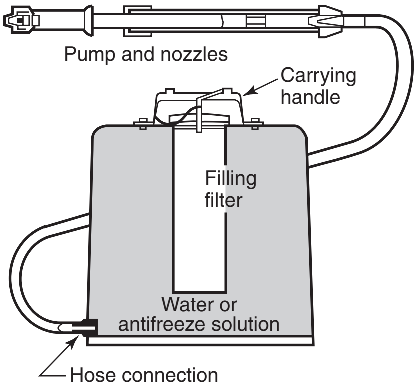


FIGURE D.4.1.4 Pump Tank Backpack Fire Extinguisher.

D.4.1.5 Wetting Agent. Extinguishers of this type are usually available in hand portable models of 1½ gal (5.7 L) capacity and in wheeled models having liquid capacities of 45 gal and 60 gal (170 L and 228 L). These extinguishers have ratings of 2-A, 30-A, and 40-A, respectively. The extinguishing agent used is a surface-active material added to water in proper quantities to materially reduce the surface tension of the water and thus increase penetrating and spreading characteristics *(see* NFPA 18, *Standard on Wetting Agents*). Hand portable models are of the stored-pressure design and are operated essentially the same as other stored-pressure types. Wheeled extinguishers are operated by a separate carbon dioxide cartridge containing the expellant gas, which, when released, expels the agent through the hose nozzle. These extinguishers need to be protected from exposure to temperatures below 40°F (4°C).

D.4.1.6 Fire Pails, Drums with Pails, and Bucket Tanks.

D.4.1.6.1 Small water supplies applied with fire pails are of limited fire-extinguishing value. The following combinations are considered as possessing two units of extinguishing potential (2-A) for Class A fires:

(1) Five 12 qt (11 L) water-filled standard fire pails
(2) Six 10 qt (9 L) water-filled standard fire pails

(3) Drum, cask, or barrel of approximately 55 gal (208 L) capacity, with at least three standard fire pails attached
(4) Bucket tanks of 25 gal to 55 gal (95 L to 208 L) capacity, with standard fire pails [either D.4.1.6.1(1) or D.4.1.6.1(2)] immersed therein

D.4.1.6.2 Standard fire pails are made of galvanized steel of at least No. 24 USS gauge, with rounded bottoms welded in place or otherwise suitably reinforced, furnished with stamped ears welded in place, and with strong wire bail and loose-fitting metal covers to exclude debris and retard evaporation.

D.4.1.6.3 Casks, drums, or barrels should preferably be of metal of No. 24 USS gauge thickness or better and should have covers. Fire pails can be hung on sides of the containers or immersed therein. Pails, casks, drums, or bucket tanks should be painted bright red with the word "FIRE" stenciled in large letters on their outside with black or other contrasting colored paint. If antifreezing solution is used, the surfaces of pails, drums, or bucket tanks should be coated with red lead or oil, followed by a coat of asphalt-base paint. Casks should be heavily coated with pitch.

D.4.1.6.4 When located where continued temperatures below 40°F (4°C) could be encountered, containers should be filled with an antifreeze solution consisting of 75 percent to 80 percent calcium chloride (free from magnesium chloride) dissolved in water. Table D.4.1.6.4 shows the approximate temperature at which various solutions will freeze.

Table D.4.1.6.4 Antifreeze Solutions [10 gal (37.9 L)]

Approx. Freezing Temp.		Water		Calcium Chloride		Specific Gravity	Degrees Baume
°F	°C	gal	L	lb	kg		
10	–12	9	34	20	9.1	1.139	17.7
0	–18	8½	32	25	11.3	1.175	21.6
–10	–23	8	30	29½	13.4	1.205	24.7
–20	–29	8	30	33½	15.2	1.228	26.9
–30	–34	8	30	36½	16.6	1.246	28.6
–40	–40	8	30	40	18.1	1.263	30.2

Note: This solution should not be used in extinguishers. Only solutions supplied by the manufacturers should be used in stored-pressure and cartridge-operated water extinguishers and in pump tank extinguishers where an antifreeze solution is desired.

FAIR USE

D.4.2 Film-Forming Foam Agents. These fire extinguishers are intended for use on Class A and Class B fires. On flammable liquid fires of appreciable depth, best results are obtained when the discharge from the fire extinguisher is played against the inside of the back wall of the vat or tank just above the burning surface to permit the natural spread of the agent back over the burning liquid. If this cannot be done, the operator should stand far enough away from the fire to allow the agent to fall lightly on the burning surface — the stream should not be directed into the burning liquid. Where possible, the operator should walk around the fire while directing the stream to get maximum coverage during the discharge period. For fires in ordinary combustible materials, the agent can be used to coat the burning surface directly. For flammable liquid spill fires, the agent could be flowed over a burning surface by bouncing it off the floor just in front of the burning area. Film-forming foam agents are not effective on flammable liquids and gases escaping under pressure or on cooking grease fires.

D.4.2.1 AFFF and FFFP. Fire extinguishers of these types are usually available in hand portable models of 1.6 gal (6 L) and 2½ gal (9.46 L) and in wheeled models having a liquid capacity of 33 gal (125 L). These fire extinguishers have ratings of 2-A:10-B, 3-A:20-B, and 20-A:160-B, respectively. The extinguishing agent is a solution of film-forming surfactant in water that forms mechanical foam when discharged through an aspirating nozzle. On Class A fires, the agent acts as both a coolant and a penetrant to reduce temperatures to below the ignition level. On Class B fires, the agent acts as a barrier to exclude air or oxygen from the fuel surface.

Grades of these agents are also suitable for the protection of water-soluble flammable liquids (polar solvents) such as alcohols, acetone, esters, ketones, and so forth. The suitability of these fire extinguishers for polar solvent fires should be referenced specifically on the nameplate. These agents are not suitable for use on pressurized fuel fires or cooking grease fires.

Specific information on the properties and limitations of AFFF and FFFP are contained in NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam.*

The hand portable models closely resemble stored-pressure water fire extinguishers except for the special types of nozzles *(see Figure D.4.2.1)*. Wheeled types are operated by a separate nitrogen cylinder containing the expellant gas, which, when released, pressurizes the agent container. The discharge is controlled by a special aspirating shutoff type of nozzle at the end of the hose assembly. These types of fire extinguishers can be used only in locations not subject to freezing conditions, unless special measures recommended by the manufacturer are provided to prevent the agent from freezing.

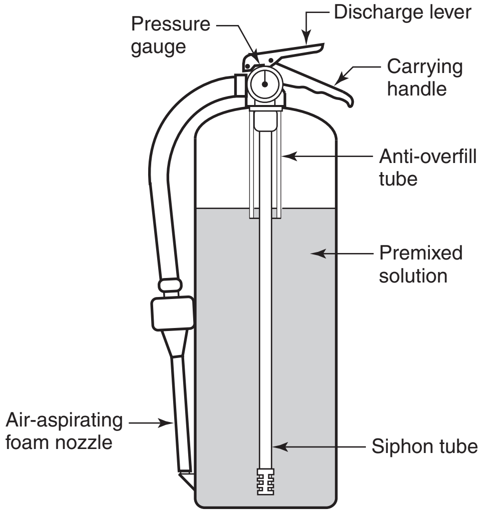


FIGURE D.4.2.1 Stored-Pressure AFFF or FFFP Liquid Extinguisher.

D.4.3 Carbon Dioxide Type. This type of fire extinguisher is primarily intended for use on Class B and Class C fires. Carbon dioxide fire extinguishers have a limited range and are affected by draft and wind; thus, initial application needs to start reasonably close to the fire. On all fires, the discharge should be directed at the base of the flames. The discharge should be applied to the burning surface even after the flames are extinguished, to allow added time for cooling and to prevent possible reflash. The most commonly used method of agent application on contained flammable liquid fires is to start at the near edge and direct the discharge in a slow, side-to-side sweeping motion, gradually progressing toward the back of the fire. The other method is called overhead application. The discharge horn is directed in a dagger or downward position (at an angle of about 45 degrees) toward the center of the burning area. Generally, the horn is not moved, as in the other method, because the discharge stream enters the fire from above and spreads out in all directions over the burning surface. For spill fires, the side-to-side sweeping motion could give better results.

On fires involving electrical equipment, discharge should be directed at the source of the flames. It is important to de-energize the equipment as soon as possible to eliminate the potential of reignition. Carbon dioxide agents are not suitable for use on pressurized fuel fires or cooking grease fires.

The carbon dioxide agent extinguishes by diluting the surrounding atmosphere with an inert gas so that oxygen levels are kept below the percentage required for combustion. When this type of fire extinguisher is used in an unventilated space, such as a small room, closet, or other confined area, prolonged occupancy of that space can result in the loss of consciousness due to oxygen deficiency.

Hand fire extinguishers of this type are usually available at capacities from 2½ lb to 20 lb (1.1 kg to 9.1 kg), having fire extinguishment ratings from 1-B:C to 10-B:C. Carbon dioxide fire extinguishers might have a limited effect on deep-seated fires in electrical enclosures. Wheeled carbon dioxide fire extinguishers are usually available in capacities from 50 lb to 100 lb (23 kg to 45 kg), having fire extinguishment ratings from 10-B:C to 20-B:C. The carbon dioxide is retained under its own pressure in a fluid condition at room temperature. The agent is self-expelling and is discharged by operation of a valve that causes the carbon dioxide to be expelled through a horn in its vapor and solid phase. To be operated, the fire extinguisher is held in an upright position, the locking ring pin is pulled, and the operating lever is squeezed. On the smaller 2 lb to 5 lb (0.91 kg to 2.3 kg) models, the discharge horn is attached to the valve assembly by a metal tube/swing joint connector. The smaller models are designed to be operated with one hand. On the larger hand portables, the discharge horn is attached to several feet of flexible hose. These fire extinguishers require a "two-hand" operation. The minimum discharge time for hand portables varies from 8 seconds to 30 seconds, depending upon size. The maximum range of the discharge stream is from 3 ft to 8 ft (1 m to 2.4 m). *[See Figure D.4.3(a) and Figure D.4.3(b).]*

D.4.4 Halogenated Agent Types. Halogenated agent fire extinguishers, which include both halon and halocarbon types, are rated for use on Class B and Class C fires. Larger models are also rated for Class A fires. On flammable liquid fires, best results are obtained when the operator uses the discharge from the fire extinguisher to sweep the flame off the burning surface, applying the discharge first at the near edge of the fire and gradually progressing toward the back of the fire by moving the discharge nozzle slowly from side to side. In using fire extinguishers of this type in unventilated places, such as small rooms, closets, or confined spaces, operators and other persons should avoid breathing the extinguishing agent or the gases produced by thermal decomposition. These agents are not suitable for use on pressurized fuel fires or cooking grease fires.

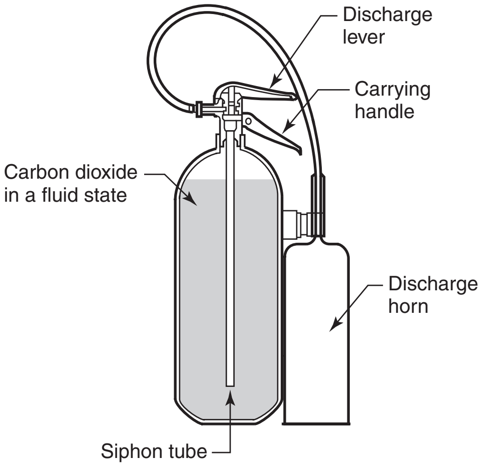


FIGURE D.4.3(a) Large Carbon Dioxide Extinguisher.

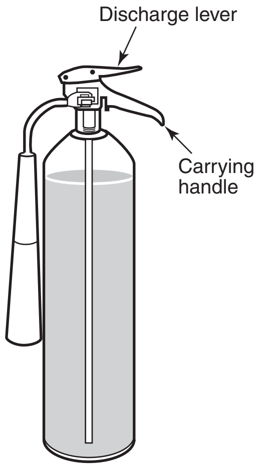


FIGURE D.4.3(b) Small Carbon Dioxide Extinguisher.

D.4.4.1 Bromochlorodifluoromethane (Halon 1211). Stored-pressure fire extinguishers of this type are available in capacities from 2 lb to 22 lb (0.91 kg to 10 kg), having fire extinguishment ratings from 2-B:C to 4-A:80-B:C, and as wheeled models with a capacity of 150 lb (68 kg) and a fire extinguishment rating of 30-A:160-B:C. Although the agent is retained under pressure in a liquid state and is self-expelling, a booster charge of nitrogen is added to ensure proper operation. Upon actuation, the vapor pressure causes the agent to expand so that the discharge stream consists of a mixture of liquid droplets and vapor. The smaller sizes have a horizontal stream range of 9 ft to 15 ft (2.7 m to 4.6 m) that is not affected by wind as much as carbon dioxide and Halon 1301 are. Deep-seated Class A fires could need to be broken apart to effect complete extinguishment. On Class B fires, the discharge is applied in a side-to-side motion, gradually progressing toward the back of the fire. The fire extinguisher should be discharged initially from not closer than 8 ft (2.4 m) to prevent splashing when used on depths of flammable liquid. *(See Figure D.4.4.1.)*

D.4.4.2 Bromochlorodifluoromethane/Bromotrifluoromethane (Halon 1211/1301) Mixtures. Fire extinguishers of this type are available in capacities from 1 lb to 20 lb (0.45 kg to

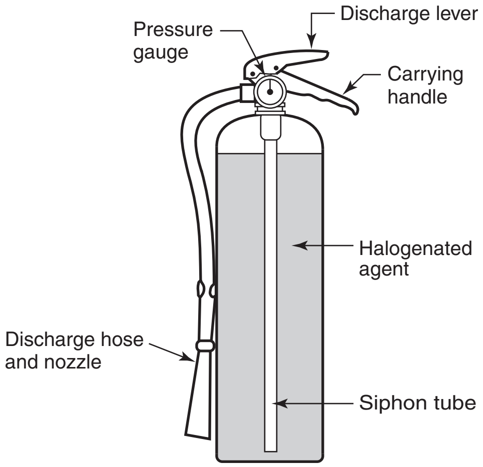
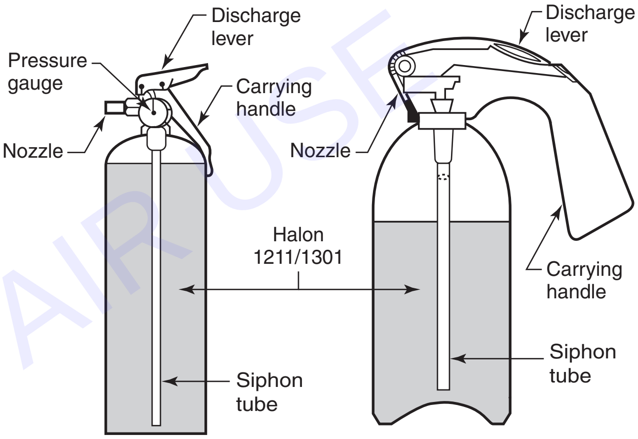


FIGURE D.4.4.1 Halogenated Agent–Type Stored-Pressure Fire Extinguisher.

9 kg), having fire extinguishment ratings from 1-B:C to 4-A:80-B:C. The halogenated agent mixture is retained under pressure in a liquid state and is self-expelling. Some of these fire extinguishers are superpressurized with nitrogen. Upon actuation, the vapor pressure causes the agent to expand so that the discharge stream is in the form of a gas/mist. These extinguishers have a horizontal stream range of 3 ft to 18 ft (0.9 m to 5.5 m) that is not affected by wind as much as carbon dioxide and Halon 1301 are. Deep-seated Class A fires could need to be broken apart to effect complete extinguishment. On Class B fires, the discharge is applied in a side-to-side motion, progressing toward the back of the fire. *(See Figure D.4.4.2.)*



FAIR USE

(a) Stored-pressure type with gauge **(b) Self-expelling type**

FIGURE D.4.4.2 Halon 1211/1301 Extinguishers.

D.4.5 Dry Chemical Types. Dry chemical fire extinguishers (sodium bicarbonate, potassium bicarbonate, potassium bicarbonate urea base, bicarbonate urea base, or potassium chloride base) are intended primarily for use on Class B and Class C fires. Dry chemical fire extinguishers (multipurpose ammonium phosphate base) are intended for use on Class A, Class B, and Class C fires. There are two methods whereby a dry chemical agent can be discharged from a fire extinguisher shell, depending on the basic design of the fire extinguisher. They are the cartridge/cylinder-operated method and the stored-pressure method. Regardless of fire extinguisher design, the method of agent application is basically the same. Stored-pressure fire extinguishers are available in capacities from 1 lb to 30 lb (0.5 kg to 14 kg) for hand fire extinguishers and 125 kg to 250 lb (57 kg to 113.5 kg) for wheeled fire extinguishers. Cartridge/cylinder-operated fire extinguishers are available in capacities from 4 lb to 30 lb (1.8 kg to 14 kg) for hand fire extinguishers and 45 lb to 350 lb (20 kg to 159 kg) for wheeled fire extinguishers.

Dry chemical fire extinguishers are also available in nonrechargeable, nonrefillable types that contain the agent and expellant gas in a single, nonreusable, factory-filled container. Most dry chemical fire extinguishers having ratings of 20-B and less will discharge their contents in 8 seconds to 20 seconds. Fire extinguishers with higher ratings could take as long as 30 seconds. Therefore, since there is little time for experimentation, it is important that the operator be prepared to apply the agent correctly at the outset. All dry chemical fire extinguishers can be carried and operated simultaneously and can be discharged intermittently. The discharge stream has a horizontal range of 5 ft to 30 ft (1.5 m to 9.2 m), depending on fire extinguisher size. When used on outdoor fires, maximum effectiveness can be achieved when the direction of the wind is on the back of the operator. *[See Figure D.4.5(a) and Figure D.4.5(b).]*

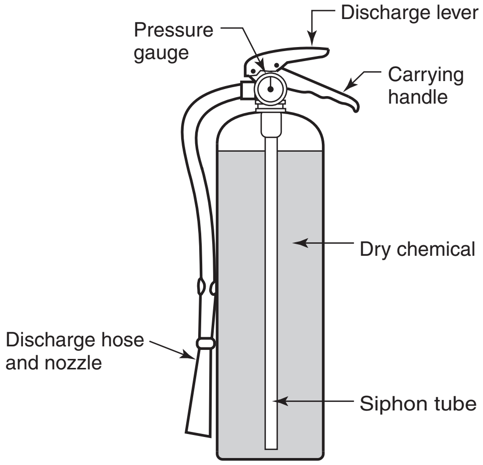


FIGURE D.4.5(a) Stored-Pressure Dry Chemical Extinguisher.

Special long-range nozzles are available where potential fire-fighting conditions could require greater distance. These nozzles are also useful on pressurized gas or liquid fires, or where strong winds prevail. All dry chemical agents can be used at the same time that water (straight stream or fog) is being applied. The use of dry chemical fire extinguishers on wet energized electrical equipment (such as rain-soaked utility poles, high-voltage switch gear, and transformers) can aggravate electrical leakage problems. The dry chemical, in combination with moisture, provides an electrical path that can reduce the effectiveness of insulation protection. The removal of all traces of dry chemical from such equipment after extinguishment is recommended. *[See Figure D.4.5(c).]*

Fire extinguishers with a Class B rating can extinguish a fire involving combustible cooking media (vegetable or animal

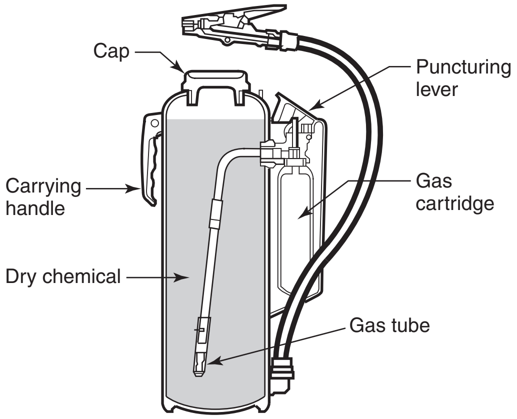


FIGURE D.4.5(b) Cartridge-Operated Dry Chemical Extinguisher.

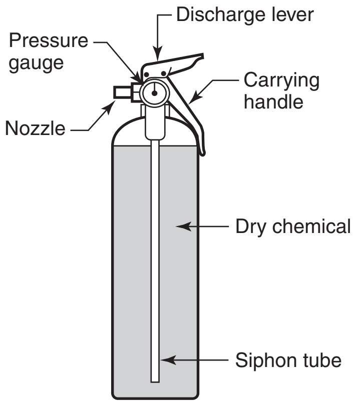


FIGURE D.4.5(c) Stored-Pressure Dry Chemical Extinguisher with Fixed Nozzle.

FAIR USE

oils and fats). Only fire extinguishers having a Class K rating are recommended for use on cooking grease fires.

D.4.5.1 Ordinary Dry Chemical Extinguishers (Class B and Class C Fires). Hand fire extinguishers of this type are available with fire-extinguishing ratings of 1-B:C to 160-B:C and as wheeled models having fire extinguishment ratings from 80-B:C to 640-B:C. The fire extinguishing agent used is a specially treated material in a finely divided form. Types of agents available include sodium bicarbonate base, potassium bicarbonate base, potassium chloride base, and potassium bicarbonate urea base. Some formulations of these agents are specially treated to be relatively compatible for use with air foam (mechanical foam). For use on flammable liquid fires, the stream should be directed at the base of the flame. Best results are generally obtained by attacking the near edge of the fire and progressing toward the back of the fire by moving the nozzle rapidly with a side-to-side sweeping motion. Care should also be taken not to direct the initial discharge directly at the burning surface at close range [less than 5 ft to 8 ft (1.5 m to 2.4 m)] because the high velocity of the stream can cause splashing or scattering of the burning material, or both. Although not listed for use on Class A fires, ordinary dry chemical can be used to rapidly knock down the flames. Once the flames are extinguished, the operator can kick or poke apart the fire debris, to assist and hasten the natural cooling of the burning embers. Hot spots or small areas that reignite can be controlled with short intermittent bursts of agent. Water should then be applied to extinguish burning embers or deep-seated hot spots. It is recommended that this method of extinguishment be attempted only if the operator has had training and experience in this technique.

Fire extinguishers with a Class B rating can extinguish a fire involving combustible cooking media (vegetable or animal oils and fats). Only fire extinguishers having a Class K rating are recommended for use on cooking grease fires.

D.4.5.2 Multipurpose Dry Chemical Extinguishers (Class A, Class B, and Class C Fires). Fire extinguishers of this type contain an ammonium phosphate base agent. Hand fire extinguishers are available with fire extinguishment ratings of 1-A to 20-A and 10-B:C to 120-B:C, and wheeled models have fire extinguishment ratings of 20-A to 40-A and 60-B:C to 320-B:C. Multipurpose agents are used in exactly the same manner as ordinary dry chemical agents on Class B fires. For use on Class A fires, the multipurpose agent has the additional characteristic of softening and sticking when in contact with hot surfaces. In this way, it adheres to burning materials and forms a coating that smothers and isolates the fuel from air. When applying the agent, it is important to try to coat all burning areas in order to eliminate or minimize the number of small embers that could be a potential source of reignition. The agent itself has little cooling effect, and, because of its surface coating characteristic, it cannot penetrate below the burning surface. For this reason, extinguishment of deep-seated fires might not be accomplished unless the agent is discharged below the surface or the material is broken apart and spread out.

Fire extinguishers with a Class B rating can extinguish a fire involving combustible cooking media (vegetable or animal oils and fats). Only fire extinguishers having a Class K rating are recommended for use on cooking grease fires.

D.4.6 Dry Powder Types. These fire extinguishers and agents are intended for use on Class D fires and specific metals, following special techniques and manufacturer's recommendations for use. The extinguishing agent can be applied from a fire extinguisher or by scoop and shovel. The technique of applying the agent to the fire varies with the type and form of the agent and combustible metal. The application of the agent should be of sufficient depth to cover the fire area adequately and provide a smothering blanket. Additional applications can be necessary to cover any hot spots that could develop. The material should be left undisturbed until the mass has cooled before disposal is attempted. Care should be taken to avoid scattering the burning metal. Fires in finely divided combustible metal or combustible metal-alloy scrap that is moist, wet with water or water-soluble machine lubricants, or on water-wetted surfaces are likely to burn rapidly and violently. They can even be of an explosive nature. They can develop so much heat that they cannot be approached closely enough to permit proper application of the extinguishing medium. Where the burning metal is on a combustible surface, the fire should be covered with dry powder, then a 1 in. or 2 in. (25.4 mm or 51 mm) layer of powder should be spread out nearby and the burning metal shoveled into this layer, with more dry powder added as needed.

D.4.6.1 Dry Powder Extinguisher. Dry powder fire extinguishers are available in a hand portable, 30 lb (14 kg) cartridge-operated model and 150 lb (68 kg) and 350 lb (159 kg) cylinder-operated wheeled models. Stored-pressure dry powder fire extinguishers with an extension wand applicator are available in a 30 lb (14 kg) model. The extinguishing agent is composed of sodium chloride, with additives to render it free flowing in order to cause it to form a crust over the fire. A thermoplastic material is added to bind the sodium chloride particles into a solid mass when applied on burning metals. Other specialized dry powder agents are available for use in fighting specific types of metal fires. With the nozzle fully opened, the hand portable models have a range of 6 ft to 8 ft (1.8 m to 2.4 m). The method of agent application depends on the type of metal, the quantity that is burning, and its physical form. In the case of a very hot fire, initial discharge should be started at maximum range with the nozzle fully opened. Once control is established, the nozzle valve should be partially closed to produce a soft, heavy flow so that complete coverage can be accomplished safely at close range. The nozzle is designed so that the operator can throttle or reduce the rate and force of the agent discharge. Since combustible metal fires can produce complex and difficult fire-fighting conditions, it is advisable to get specific details on equipment use from the manufacturer. *[See Figure D.4.6.1(a) and Figure D.4.6.1(b).]*

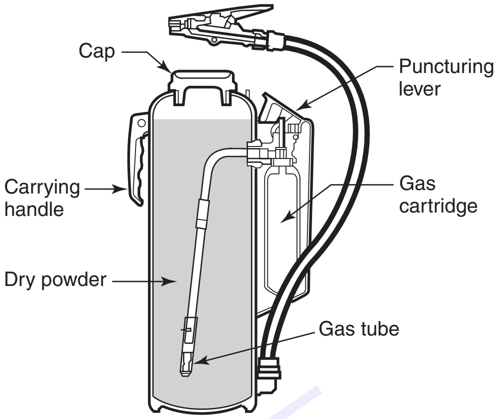


FIGURE D.4.6.1(a) Cartridge-Operated Dry Powder Extinguisher.

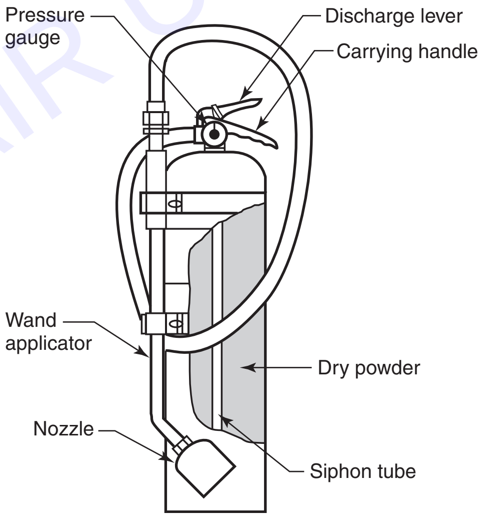


FIGURE D.4.6.1(b) Stored-Pressure Dry Powder Extinguisher with Wand Applicator.

D.4.6.2 Bulk Dry Powder Agent. In bulk form, dry powder extinguishing agents are available in 40 lb and 50 lb (18 kg and 23 kg) pails and 350 lb (159 kg) drums. In addition to the sodium chloride base agent, a dry powder material called G-1 is also available. This material consists of graded, granular graphite to which compounds containing phosphorus are added, improving its fire-extinguishing effectiveness. Whereas the sodium chloride can be used in a dry powder fire extinguisher or applied by shovel or hand scoop, the G-1 agent needs to be applied to the fire by hand. When G-1 is applied to a metal fire, the heat of the fire causes the phosphorus compounds to generate vapors that blanket the fire and prevent air from reaching the burning metal. The graphite, being a good conductor of heat, cools the metal to below the ignition point. Each extinguishing agent is listed for use on the specific combustible metal fires for which it has been found acceptable, as determined by individual investigations. Such information, together with the recommended method of application limitations, is given on the agent container. It is important to note that dry powder extinguishing agents should not be confused with dry chemical extinguishing agents. *(See D.4.5.)*

D.4.7 Wet Chemical Extinguisher. Fire extinguishers of this type are available in hand portable models of 1½ gal (6 L) and 2½ gal (9.46 L). The extinguishing agent can be comprised of, but is not limited to, solutions of water and potassium acetate, potassium carbonate, potassium citrate, or a combination of these chemicals (which are conductors of electricity). The liquid agent typically has a pH of 9.0 or less. On Class A fires, the agent works as a coolant. On Class K fires (cooking oil fires), the agent forms a foam blanket to prevent reignition. The water content of the agent aids in cooling and reducing the temperature of the hot oils and fats below their autoignition point. The agent, when discharged as a fine spray directly at cooking appliances, reduces the possibility of splashing hot grease and does not present a shock hazard to the operator.

In recent years, the development of high-efficiency cooking equipment with high-energy input rates and the widespread use of vegetable oils with high autoignition temperatures has highlighted the need for a new Class K fire extinguisher. The wet chemical extinguisher was the first extinguisher to qualify to the new Class K requirements.

In addition to offering rapid fire extinguishment, a thick foam blanket is formed to prevent reignition while cooling both the appliance and the hot cooking oil. Wet chemical extinguishers also offer improved visibility during fire fighting as well as minimizing cleanup afterward. *(See Figure D.4.7.)*

D.4.8 Water Mist Extinguisher. Fire extinguishers of this type are available in 2.5 gal (9.5 L) and 1.75 gal (6.6 L) sizes. They have ratings of 2-A:C. The agent is limited to distilled water, which is discharged as a fine spray. In addition to being used as a regular water extinguisher, water mist extinguishers are used where contaminants in unregulated water sources can cause excessive damage to personnel or equipment. Typical applications include operating rooms, museums, and book collections. *(See Figure D.4.8.)*

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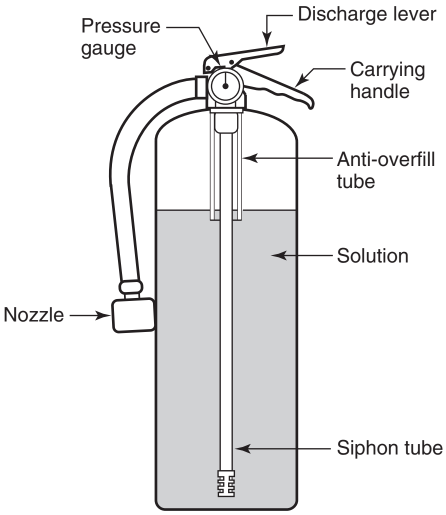

FIGURE D.4.7 Wet Chemical Extinguisher.

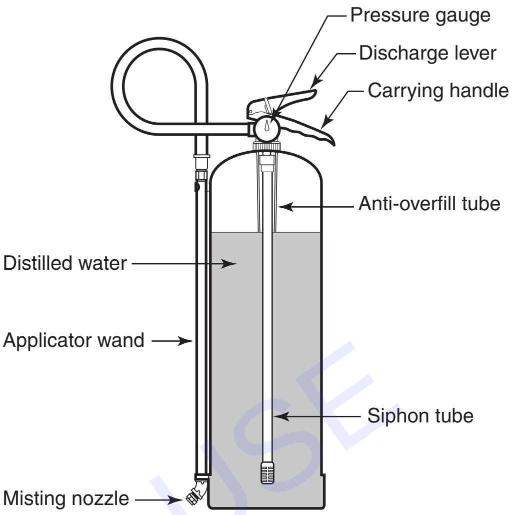

FIGURE D.4.8 Water Mist Extinguisher.

FAIR USE

Annex E Distribution

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

E.1 Distribution of Fire Extinguishers.

E.1.1 Portable fire extinguishers are most effectively utilized when they are readily available in sufficient number and with adequate extinguishing capacity for use by persons familiar with their operation.

E.1.2 In fire emergencies where fire extinguishers are relied upon, someone usually has to travel from the fire in order to obtain the device and then return to the fire before beginning extinguishing operations. This takes time, with the number of seconds or minutes governed mainly by the travel distance involved in securing the fire extinguisher and placing it in operation.

E.1.3 Sometimes fire extinguishers are purposely kept nearby (as in welding operations); however, since a fire outbreak usually cannot be prejudged as to location, fire extinguishers are more often strategically positioned throughout areas.

E.1.4 Travel distance is not merely a simple circle radius matter but is the actual distance the user of the fire extinguisher will need to walk. Consequently, travel distance will be affected by partitions, location of doorways, aisles, piles of stored materials, machinery, and so forth.

E.2 Arrangement in a Building. The actual placement of fire extinguishers can best be accomplished through a physical survey of the area to be protected. In general, selected locations should have the following characteristics:

(1) Provide uniform distribution
(2) Provide easy accessibility
(3) Be relatively free from blocking by storage and equipment, or both
(4) Be near normal paths of travel
(5) Be near entrance and exit doors
(6) Be free from the potential of physical damage
(7) Be readily visible
(8) Be determined on a floor-by-floor basis

E.3 Class A Fire Extinguisher Distribution.

E.3.1 Table 6.2.1.1 is a guideline for determining the minimum number and rating of fire extinguishers for Class A fire protection needs in accordance with the occupancy hazard. In certain instances, through a fire protection analysis of specific areas, process hazards, or building configurations, fire extinguishers with higher ratings can be required. This does not mean, however, that the recommended maximum travel distances can be exceeded.

E.3.2 Where the floor area of a building is less than 3000 ft^2 (279 m^2), at least one fire extinguisher of the minimum size recommended should be provided.

The first step in calculating Class A fire extinguisher needs is to determine the proper class of occupancy (light, ordinary, or extra hazard). Depending on the rating of the fire extinguisher (1-A to 40-A), the maximum area that it will protect can be determined. For example, each 2½ gal (9.46 L) stored-pressure water fire extinguisher (rated 2-A) will protect an area of 3000 ft^2 (279 m^2) in an ordinary hazard occupancy. The requirements in Table 6.2.1.1 also specify that the travel distance (actual walking distance) from any point to the nearest fire extinguisher shall not exceed 75 ft (22.9 m). It is necessary to select fire extinguishers that fulfill both the distribution and travel distance requirements for a particular occupancy classification.

E.3.3 If a building floor area is unobstructed and circular in shape with a radius of 75 ft (22.9 m), it would be possible to place one fire extinguisher at the center without exceeding the 75 ft (22.9 m) travel distance. In that case, an area of 17,700 ft^2 (1644 m^2) could be assigned to one fire extinguisher of adequate A rating; for example, light hazard, 6-A; ordinary hazard, 20-A (no 12-A fire extinguisher ratings); extra hazard, 20-A (no 18-A fire extinguisher ratings). However, because buildings are usually rectangular in shape, the largest square area that can be formed with no point more than 75 ft (22.9 m) from the center is 11,250 ft^2 (1045 m^2), which is the area of a square [106 ft × 106 ft (32 m × 32 m)] inscribed within a 75 ft (22.9 m) radius circle. *(See Figure E.3.3.)*

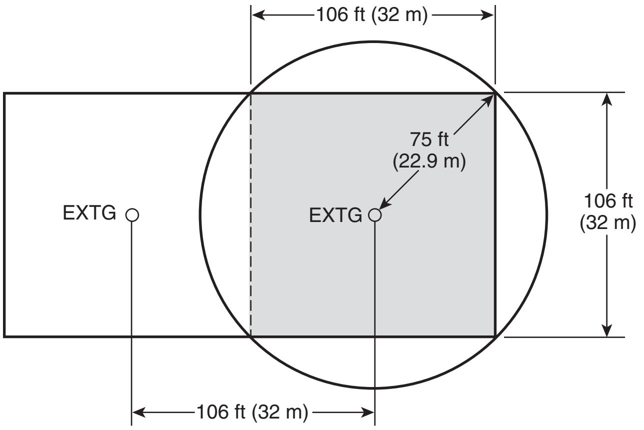

FIGURE E.3.3 Extinguishers Placed 106 ft (32 m) Apart to Comply with the 75 ft (22.9 m) Travel Distance and 11,250 ft^2 (1045 m^2) Maximum Floor Area per Extinguisher.

E.3.4 The following examples of distribution illustrate the number and placement of fire extinguishers according to occupancy type and rating. The sample building is 150 ft × 450 ft (45.7 m × 137.2 m), giving a floor area of 67,500 ft^2 (6271 m^2). Although several different ways of placing fire extinguishers are given, a number of other locations could have been used, with comparable results.

The area that can be protected by one fire extinguisher with a given A rating is shown in Table E.3.4. These values are determined by multiplying the maximum floor area per unit of A shown in Table 6.2.1.1 by the various A ratings, until a value of 11,250 ft^2 (1045 m^2) is exceeded.

Table E.3.4 Maximum Area in Square Feet to Be Protected per Extinguisher

Class A Rating Shown on Extinguisher	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
1-A	—	—	—
2-A	6,000	3,000	—
3-A	9,000	4,500	—
4-A	11,250	6,000	4,000
6-A	11,250	9,000	6,000
10-A	11,250	11,250	10,000
20-A	11,250	11,250	11,250
30-A	11,250	11,250	11,250
40-A	11,250	11,250	11,250

For SI units, 1 ft^2 = 0.0929 m^2.
Note: 11,250 ft^2 is considered a practical limit.

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E.3.5 The first example demonstrates placement at the maximum protection area limits [11,250 ft^2 (1045 m^2)] allowed in Table 6.2.1.1 for each class of occupancy. Installing fire extinguishers with higher ratings will not affect distribution or placement.

Example 1:

$$\frac{67{,}500\text{ ft}^2}{11{,}250\text{ ft}^2} = 6 \begin{cases} \text{4-A extinguishers for light hazard occupancy} \\ \text{10-A extinguishers for ordinary hazard occupancy} \\ \text{20-A extinguishers for extra hazard occupancy} \end{cases}$$

E.3.6 This placement, along outside walls, would not be acceptable because the travel distance rule is clearly violated. In Figure E.3.6, relocation or additional fire extinguishers, or both, are needed. The shaded areas indicate "voids" that are farther than 75 ft (22.9 m) to the nearest extinguisher. The dots represent extinguishers.

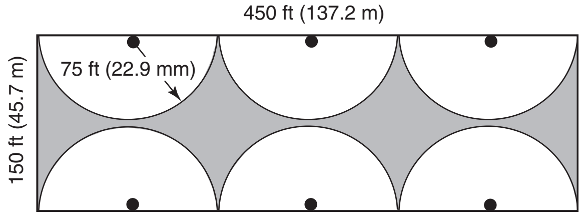

FIGURE E.3.6 A Diagrammatic Representation of Extinguishers Located Along the Outside Walls of a 450 ft × 150 ft (137.2 m × 45.7 m) Building.

E.3.7 Example 2 is for fire extinguishers having ratings that correspond to protection areas of 6000 ft^2 (557 m^2). Example 3 is for extinguishers having the minimum ratings permitted by Table 6.2.1.1 with corresponding minimum protection areas. As the number of lower-rated extinguishers increases, meeting the travel distance requirement generally becomes less of a problem.

Example 2:

$$\frac{67{,}500\text{ ft}^2}{6000\text{ ft}^2} = 12 \begin{cases} \text{2-A extinguishers for light hazard occupancy} \\ \text{4-A extinguishers for ordinary hazard occupancy} \\ \text{6-A extinguishers for extra hazard occupancy} \end{cases}$$

Example 3:

$$\frac{67{,}500\text{ ft}^2}{6000\text{ ft}^2} = 12 \text{ 2-A extinguishers for light hazard occupancy}$$

$$\frac{67{,}500\text{ ft}^2}{3000\text{ ft}^2} = 23 \text{ 2-A extinguishers for ordinary hazard occupancy}$$

$$\frac{67{,}500\text{ ft}^2}{4000\text{ ft}^2} = 17 \text{ 4-A extinguishers for extra hazard occupancy}$$

E.3.8 Fire extinguishers could be mounted on exterior walls or, as shown in Figure E.3.8, on building columns or interior walls, and conform to both distribution and travel distance rules.

E.3.9 The arrangement illustrated in Figure E.3.9 shows fire extinguishers grouped together on building columns or interior walls in a manner that still conforms to distribution and travel distance rules.

E.4 Class B Fire Extinguisher Distribution.

E.4.1 Normal Class B fire hazards fall into two quite different general categories regarding requirements for fire extinguishers. One condition is where the fire does not involve flammable liquids in appreciable depth, such as spilled fuel on an open surface, a fire involving vapors issuing from a container or piping system, or a running fire from a broken container.

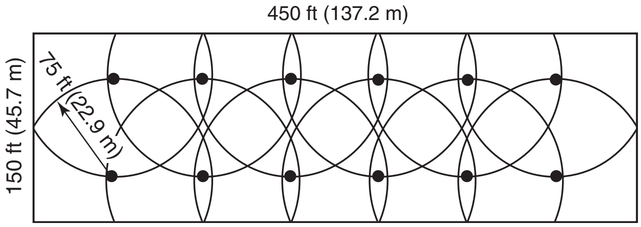

FIGURE E.3.8 Configuration Representing 12 Fire Extinguishers Mounted on Building Columns or Interior Walls, in Which Requirements for Both Travel Distance and Fire Extinguisher Distribution Are Met.

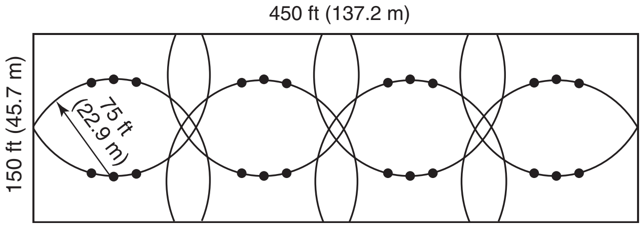

FIGURE E.3.9 Fire Extinguishers Grouped Together.

E.4.2 The other condition is where the fire involves flammable liquids in appreciable depth [defined as a depth of liquid greater than ¼ in. (6.3 mm)], such as fires involving open tanks of flammable liquids commonly found in industrial plants (dip tanks used for coating, finishing, treating, or similar processes).

E.4.3 In situations where flammable liquids are not in appreciable depth, fire extinguishers should be provided according to Table 6.3.1.1. Once the type of hazard is determined, the selected Class B fire extinguisher should have a rating equal to or greater than that specified and be so located that the maximum travel distance is not exceeded.

E.4.4 The reason the basic maximum travel distance to Class B fire extinguishers is 50 ft (15.25 m), as opposed to 75 ft (22.9 m) for Class A fire extinguishers, is that flammable liquid fires reach their maximum intensity almost immediately. It is imperative that the fire extinguisher be brought to the fire in a much shorter period of time than that allowed for a slower developing Class A fire.

E.4.5 Even though Table 6.3.1.1 specifies maximum travel distances for Class B fire extinguisher placement, judgment should be exercised in actually establishing them. The fire extinguisher can be placed closer to the hazard it is protecting, up to a point where the fire extinguisher itself might be involved in the fire or access to it made difficult because of flame, heat, or smoke.

E.4.6 Where an entire room or area is judged to be a Class B hazard (such as an automobile repair garage), fire extinguishers should be placed at regular intervals so that the maximum walking distance from any point to the nearest fire extinguisher does not exceed the travel distances specified in Table 6.3.1.1.

For fires in flammable liquids of appreciable depth, a Class B fire extinguisher is provided on the basis of two numerical units of Class B extinguishing potential per 1 ft^2 (0.0929 m^2) of flammable liquid surface for the largest tank within the area. The travel distance requirements in Table 6.3.1.1 should also be used to locate fire extinguishers for spot hazard protection; however, the type of hazard and the availability of the fire extinguisher should be carefully evaluated.

E.4.7 One fire extinguisher can be installed to provide protection against several hazards, provided travel distances are not exceeded. Where hazards are scattered or widely separated and travel distances are exceeded, individual protection should be installed according to the square foot rule.

E.4.8 Where fixed Class B extinguishing systems are installed, the provision of portable fire extinguishers can be waived for that one hazard but not for the structure, other special hazards, or the rest of the contents. Sometimes a burning tank can result in burning liquid spills outside the range of the fixed equipment, or the fire could originate adjacent to the tank rather than in its liquid content. Therefore, having portable fire extinguishers available is desirable, even though hazards of this type are protected with fixed extinguishing systems.

E.4.9 The selection of the proper type and size of Class B fire extinguishers for fires in pressurized fuels is made on the basis of the recommendations of the manufacturers of this specialized equipment available for that type of hazard. Special nozzle design and rates of agent application are necessary in order to be able to cope with hazards of this magnitude. Also, it is generally undesirable to attempt to extinguish pressurized fuel fires unless there is reasonable assurance that the source of fuel can be shut off promptly, thus avoiding a possible explosion. The travel distances for hand portable fire extinguishers should not exceed those specified in Table 6.3.1.1.

E.4.10 Only Class K fire extinguishers are recommended for cooking grease fires. Maximum travel distance is 30 ft (9.15 m) as defined in 6.6.2.

E.5 Class C Fire Extinguisher Distribution.

E.5.1 To protect fire extinguisher operators in situations where live electrical equipment could be encountered, fire extinguishers with Class C ratings are required.

E.5.2 When the power to a piece of electrical equipment is cut off, the fire changes character to that of a Class A, a Class B, or a combined Class A and B fire, depending on the nature of the burning electrical components and any material burning in the immediate vicinity.

E.5.3 De-energizing electrical equipment eliminates the possibility of shock hazards to the fire extinguisher operator if the operator accidentally comes into physical contact with the equipment, or if the operator brings any conductive part of a fire extinguisher within arcing distance. De-energizing also eliminates fault currents from prolonging the fire or from being a source of reignition. Switches or circuit breakers that cut electric power to specific equipment can prevent hazardous side effects (e.g., plunging an entire multistory building into darkness or shutting down the essential electric power that supplies life support equipment). Often, fires involving an electrical component are relatively minor and, by a short application of a Class C extinguishant, can be effectively extinguished without disturbing electrical continuity.

E.5.4 The capacity of the fire extinguishers supplied for each major Class C hazard situation should be individually judged according to the following factors:

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(1) Size of the electrical equipment
(2) Configuration of the electrical equipment (particularly the enclosures of units) that influences agent distribution
(3) Effective range of the fire extinguisher stream
(4) Amount of Class A and B material involved

Each of these factors influences the amount and type of agent needed, the desired rate of agent discharge, the associated duration of application, and the potential wastage factors.

E.5.5 For large installations of electrical apparatus where the power continuity is critical, fixed fire protection is desirable. At locations where such fixed systems are installed, it is practical to also provide Class C portable fire extinguisher units to handle quickly discovered fires: obviously, the number and size of these units can be reduced under such conditions.

E.6 Class D Fire Extinguisher Distribution.

E.6.1 For Class D hazards, the availability of special portable fire extinguishers (or equivalent equipment to contain or extinguish any fire developing in a combustible metal) is particularly important. Extinguishing equipment for such fires should be located no more than 75 ft (22.9 m) from the hazard.

E.6.2 Use of the wrong fire extinguisher can instantly increase or spread the fire. Quantitatively, the amount of agent needed is normally measured by the surface area of combustible metals that might become involved, plus the potential severity of the fire as influenced by the shape and form of the metal. Because fires in magnesium fines are more difficult to extinguish than fires involving magnesium scrap, the amount of agent needed to handle fires in magnesium fines is correspondingly greater. Fire extinguishers labeled for Class D fires are not necessarily equally effective on all combustible metal fires. Often, fire extinguishers so labeled might be hazardous when used on some metal fires. Unless the effect of the extinguishing agent is known for the metal being considered, tests should be made with representative material.

FAIR USE

E.7 Sample Problem. A light-occupancy office building is to be protected by portable fire extinguishers. The floor area is 11,100 ft^2 (1031 m^2) and of unusual design. *(See Figure E.7.)*

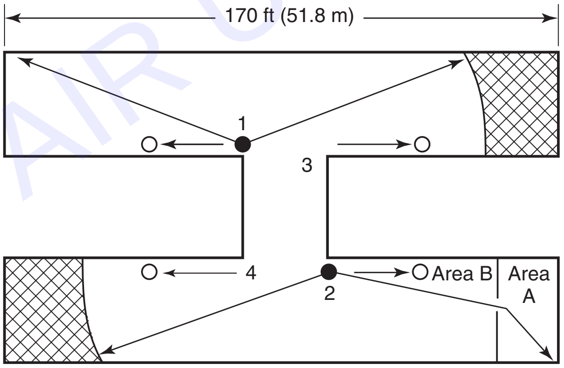

FIGURE E.7 Floor Plan for Sample Problem.

The most common fire extinguisher selections would be 2½ gal (9.46 L) stored-pressure water models rated 2-A. According to Table 6.2.1.1 and Table E.3.4, two fire extinguishers are needed (11,100 ÷ 6000 = 2). Travel distance requirements are 75 ft (22.9 m) maximum.

The two units are placed at points 1 and 2, and a check is made on the travel distance requirement. Because of the area's unusual shape, it is found that the shaded areas exceed the 75 ft (22.9 m) distance. Two additional fire extinguishers (at points 3 and 4) are needed. The additional fire extinguishers afford more flexibility in placement, and alternate locations are indicated. It is important to consider any partitions, walls, or other obstructions in determining the travel distance.

As an additional item, consider that Area A contains a small printing and duplicating department that uses flammable liquids. This area is judged to be an ordinary Class B hazard. A 10-B:C or 20-B:C fire extinguisher should be specified to protect this area.

There are now two alternatives to be considered. First, a fifth fire extinguisher, either carbon dioxide or ordinary dry chemical, with a rating of 10-B:C or 20-B:C could be specified. Second, the water fire extinguisher at point 2 could be replaced with a multipurpose dry chemical fire extinguisher that has a rating of at least 2-A:10-B:C. It should be located near point B, keeping in mind the 75 ft (22.9 m) travel distance for the 2-A protection and the 30 ft or 50 ft (9.1 m or 15.25 m) travel distance required for the Class B protection that this fire extinguisher provides.

Annex F Selection of Residential Fire-Extinguishing Equipment

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

F.1 Definitions.

F.1.1 General Use Residential Fire Extinguisher. A fire extinguisher that has been specifically investigated, tested, and listed for use only in and around the home (one- and two-family dwellings and living units within multifamily structures) for the purpose of suppressing or extinguishing a fire.

F.1.2 Special Purpose Residential Fire Extinguisher. A fire extinguisher designed, tested, and listed for a particular type of hazard as specified on its label.

F.2 Multifamily Structure Guidelines. The provisions of this annex section apply to the selection, installation, and maintenance of fire-extinguishing equipment for one- and two-family dwellings and living units within multifamily structures. The fire-extinguishing equipment is intended as a first line of defense to cope with fires of limited size. This equipment is needed even though the dwelling or living unit is protected by an automatic sprinkler system, fire or smoke alarm system, or both; single station smoke detectors; or other fixed fire suppression or detection system. The recommendations given herein are minimum. Depending upon the conditions existing in each living unit, additional extinguishers or extinguishers of larger capacity might be advisable.

For more information on automatic sprinkler systems for the residence, see NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, and NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*. For more information about fire or smoke alarm systems, or both, and single station smoke detectors, see *NFPA 72, National Fire Alarm and Signaling Code*.

The purpose of this annex is to provide guidance for the owners and occupants of one- and two-family dwellings and living units within multifamily structures in the selection, use, installation, and maintenance of fire-extinguishing equipment.

F.3 General Recommendations. Selection of a fire extinguisher for resident use should be made with the understanding of an extinguisher's capacity (or its rating) along with the potential fire hazards in the residence. Depending on the conditions existing in each living unit, additional extinguishers or extinguishers of larger capacity might be advisable.

The following are minimum recommendations per floor level:

(1) A single extinguisher rated 2-A:10-B:C or higher
(2) One extinguisher rated 2-A or higher and a second extinguisher rated 10-B:C or higher

F.3.1 Residence. Extinguishers installed in the residence should meet the requirements of Section 4.1 or F.4.1.

F.3.2 Attached Garages. One extinguisher rated 2-A:10-B:C or higher should be provided to protect an attached garage that is under the residence or connected to the residence by a common wall.

F.3.3 Detached Garages.

F.3.3.1 Where provided, extinguishers for detached garages should have a rating of 2-A:10-B:C or higher.

F.3.3.2 Due to the volume of flammable liquids normally present in garages (those liquids associated with automobiles, lawn mowers, snow blowers, workshops, etc.), a larger extinguisher than that meeting the minimum recommendations should be specifically installed for protection.

F.4 Fire Extinguisher Types.

F.4.1 The following types of fire extinguishers are recommended for installation and use in family dwellings and living units:

(1) Dry chemical
(2) Water, AFFF, FFFP, antifreeze, wetting agent
(3) Halogenated agent
(4) Carbon dioxide
(5) General use residential fire extinguisher
(6) Special purpose residential fire extinguisher

F.4.2 The following types of extinguishers are considered obsolete and should be removed from service and replaced:

(1) Soda acid types
(2) Chemical foam (excluding film-forming agents)
(3) Vaporizing liquid
(4) Cartridge-operated water
(5) Cartridge-operated loaded stream
(6) Copper or brass shell fire extinguishers (excluding pump tanks) joined by soft solder or rivets
(7) Extinguishers rated prior to 1955 and marked B-1, C-1 on the nameplate
(8) Fire extinguishers not listed or labeled

F.5 Application for Specific Hazards.

F.5.1 Combustible Cooking Media Fires. Combustible cooking media fires require the use of extinguishers that will extinguish the fire from a safe distance without causing splashing of the burning grease or permitting reignition of the fire. This can be achieved by a special purpose residential fire extinguisher listed for residential grease fires or an automatic fire extinguisher unit listed for residential range top protection. An ABC dry chemical extinguisher is not the extinguisher of choice because of the possibility of reignition. Other agents can have limited effectiveness. Water, AFFF, and FFFP can cause dangerous splashing of burning grease and can cause fire to spread.

> **WARNING:** Do not attempt to pick up a pot or pan containing burning grease! To avoid personal injury and to avoid spreading the fire, fight the fire in place. Shut off the heat source as soon as it is safe to do so, to avoid fire reflash.

F.5.2 Electronic Equipment Fires. Where provided, extinguishers for the protection of delicate electronic equipment, such as TVs, computers, and stereos, should have a 1-B:C rating or higher and should be of the carbon dioxide or halogenated agent types.

F.5.3 An automatic residential fire extinguisher unit is designed and listed for the protection of a specific hazard. It should only be utilized in accordance with the manufacturer's specifications.

F.5.4 Due to the volume of flammable liquids normally present in garages (those liquids associated with automobiles, lawn mowers, snow blowers, workshops, etc.), a larger extinguisher than those meeting the minimum recommendations should be specifically installed for protection.

F.6 Extinguishing Equipment Guidelines.

F.6.1 Minimum Placement. A minimum of one portable fire extinguisher, with a minimum rating of 2-A:10-B:C and meeting the general recommendations of Section F.1, should be provided per floor level of a living unit, with a maximum of 40 ft (12 m) of travel distance to the equipment.

F.6.2 Installation.

F.6.2.1 Before installing any fire-extinguishing equipment, the owner/resident should read and understand the installation and use instructions, including the limitations, cautions, and warnings contained on the equipment and in the owner's manual.

F.6.2.2 Portable fire extinguishers should be installed as follows:

(1) In an accessible spot, free from blocking by storage and equipment, and near room exits that provide an escape route
(2) So that the top of the extinguisher is not more than 5 ft (1.5 m) above the floor and not less than 4 in. (101.6 mm) above the floor; should be easy to reach and remove and should be placed where it will not be damaged
(3) On hangers or in the brackets supplied by the manufacturer, mounted in cabinets, or placed on shelves
(4) Placed so that the operating instructions on the extinguisher face outward

F.6.3 Safety Precautions. For personal safety, the following precautions should be observed for locating and using a fire extinguisher:

(1) Most fires produce toxic decomposition products of combustion, and some materials can produce highly toxic gases. Fires can also consume available oxygen or produce dangerously high exposure to convected or radiated heat. All of these factors can affect the degree to which a fire can be safely approached with extinguishing equipment.

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(2) Discharging portable fire extinguishers from too close a distance on cooking grease fires can cause splashing of the burning grease or oil and spread the fire. The recommended distance for operating portable fire extinguishers is shown on the label. *(See F.5.1.)*
(3) Portable fire extinguishers should not be installed adjacent to the location of a potential fire hazard but should be accessible to the hazard.
(4) Halogenated agent extinguisher labels contain information such as the minimum volume of room that can be properly and safely protected. When using these extinguishers, avoid breathing the discharged agent or the gases produced by the thermal decomposition of the agent. Evacuate and ventilate the area immediately after use.
(5) The use of a carbon dioxide extinguisher(s) in an unventilated space can dilute the oxygen supply. Prolonged occupancy of such spaces can result in loss of consciousness due to oxygen deficiency.
(6) Extinguishers not classified for Class C hazards present a shock hazard if used on fires involving energized electrical equipment.
(7) Dry chemical extinguishers, when used in a small unventilated area, can reduce visibility for a period of up to several minutes.

If similar flammable liquids are kept in partially open carports, an extinguisher of this type should also be provided.

F.6.4 Procedures Following the Use of Fire Extinguishers. For personal safety and proper operation, it is essential that the instructions on the extinguisher label and contained in the manual be followed. It is also essential that once the extinguisher is used, it be refilled or replaced promptly. Even if only a short burst of agent is released, the extinguisher can lose the rest of its pressure.

F.7 Inspection, Maintenance, and Servicing of Residential Fire-Extinguishing Equipment.

F.7.1 General.

F.7.1.1 This section is concerned with the inspection, maintenance, and servicing of fire extinguishers.

F.7.1.2 The homeowner or occupant is responsible for ensuring that inspection, maintenance, and servicing of fire extinguishers is performed in a timely manner by competent individuals.

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F.7.2 Inspections.

F.7.2.1 Inspections should be performed when the fire extinguisher is initially placed in service and thereafter at approximately 30-day intervals. Inspections should be performed in accordance with the owner's manual supplied with the fire extinguisher.

F.7.2.2 Inspection procedures should include a check of at least the following:

(1) The equipment is in its designated place, and its operating instructions face outward.
(2) Access to the fire extinguisher is not obstructed.
(3) Operating instructions are legible.
(4) Any seals or tamper indicators are not broken, missing, or in need of replacement.
(5) Pressure gauge or indicating devices, if provided, are in the operable range or position.
(6) There is no evidence of corrosion or physical damage.

F.7.2.3 If the inspection of the fire extinguisher reveals any deficiency under F.7.2.2(1) and F.7.2.2(2), immediate corrective action should be taken by the homeowner or occupant. Deficiencies related to F.7.2.2(3) through F.7.2.2(6) indicate the need for immediate maintenance and servicing.

F.7.3 Maintenance and Servicing.

F.7.3.1 Maintenance and servicing of fire extinguishers should be performed by fire extinguisher servicing companies that have the proper tools, recharge materials, lubricants, manufacturer's servicing instructions, and replacement parts.

F.7.3.2 Manufacturer's instructions specify servicing of rechargeable fire extinguishers after any use. The frequency of internal maintenance and hydrostatic testing is specified in the owner's manual and in Table F.7.3.2.

Table F.7.3.2 Frequency of Internal Maintenance and Hydrostatic Testing of Fire Extinguishers

Type of Extinguisher	Internal Maintenance Interval (years)	Hydrostatic Testing Interval (years)
Dry chemical*	6	12
Water, AFFF, FFFP, antifreeze	5	5
Halogenated agent†	6	12
Carbon dioxide	5	5

*Nonrechargeable dry chemical extinguishers do not require a 6-year internal inspection but should be removed from service 12 years after the date of manufacture.

†Nonrechargeable halogenated agent extinguishers do not require an internal inspection but should be removed from service 12 years from the date of manufacture. The extinguishers should be returned to the manufacturer or the manufacturer's designated agent for reclaiming of the halogenated agent.

F.8 General Recommendations.

F.8.1 Fire Extinguishers.

F.8.1.1 Fire extinguishers should be maintained in a fully charged and operable condition and kept in their designated places at all times when they are not being used.

F.8.1.2 Inverting-type fire extinguishers are not recommended and should be removed from service.

F.8.2 Owner's Manual. An owner's manual is provided by the manufacturer of listed equipment, giving instructions and cautions necessary to the installation, operation, inspection, maintenance, and disposal or recharging of the fire extinguisher(s). The manual refers to this standard, as appropriate, as a source of detailed instructions. The manual should be read carefully and kept in a convenient place for future reference.

F.8.3 Principles of Fire Extinguishment. Many fires are small at origin and can be extinguished by the use of fire extinguishers or small hose streams. The fire department should be notified as soon as a fire is discovered. This alarm should not be delayed by awaiting the results of application of residential fire-extinguishing equipment.

Portable fire-extinguishing equipment can represent an important segment of a residential fire protection program. If a fire starts in the residence, people should get out of the house and the fire department called; only then should a fire extinguisher be used. These rules should be followed when fighting a residential fire with a fire extinguisher:

(1) Keep near a door that can be used as an escape route.
(2) Stay low. Avoid breathing the heated smoke, vapors, or fumes as much as possible, as well as the extinguishing agents.
(3) Use the appropriate fire-fighting equipment. If the fire is not extinguished quickly, get out of the building, closing door(s) behind you. Do not re-enter the building.

F.8.4 Responsibility. The homeowner/occupant has an obligation for the care and use of the fire-extinguishing equipment at all times. The nameplate(s) and instruction manual should be read and thoroughly understood by all persons who are expected to use the equipment. The instruction manual should be kept in a safe place and periodically reviewed.

The presence of an extinguisher in a residence is not worthwhile unless the homeowner is willing to do the following:

(1) Understand how to use the device properly.
(2) Instruct family members who might have to use it.
(3) Maintain and recharge the extinguisher according to the manufacturer's instructions. The owner/occupant should make sure that everyone knows how to call the fire department and should do so for every fire, no matter how small.

Homeowners/occupants should recognize fire hazards on their properties and plan in advance exactly how, and with what, a fire will be fought. It is important for homeowners to understand that extinguishers of the sizes discussed have a discharge time of only 8 seconds to 60 seconds; in actual use, no time can be wasted determining the best way to use the device. Instruction on fire extinguisher use can also be obtained from local fire department personnel.

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Annex G Extinguisher Classification and Rating System

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

G.1 Portable fire extinguishers are classified for use on certain classes of fires and rated for relative extinguishing effectiveness at a temperature of 70°F (21°C) by testing laboratories. This is based on the classification of fires and the fire-extinguishment potentials as determined by fire tests.

G.1.1 The classification and rating system described in this standard is that of Underwriters Laboratories Inc. and Underwriters Laboratories of Canada and is based on the extinguishment of planned fires of determined size and description as follows:

(1) *Class A Rating.* Wood
(2) *Class B Rating.* Two in. (51 mm) depth heptane fires in square pans
(3) *Class C Rating.* No fire test; special tests required to ensure the safety of the extinguisher operator
(4) *Class D Rating.* Special tests on specific combustible metal fires
(5) *Class K Rating.* Special tests on cooking appliances using combustible cooking media (vegetable or animal oils and fats)

G.1.2 The classification and rating are found on the label affixed to the fire extinguisher.

G.2 Example. A fire extinguisher is rated and classified 4-A:20-B:C, which imparts the following information:

(1) It should extinguish approximately twice as much Class A fire as a 2-A [2½ gal (9.46 L) water] rated fire extinguisher.
(2) It should extinguish approximately 20 times as much Class B fire as a 1-B rated fire extinguisher.
(3) It is suitable for use on energized electrical equipment.

Currently, laboratories classify fire extinguishers for use on Class A fires with the following ratings: 1-A, 2-A, 3-A, 4-A, 6-A, 10-A, 20-A, 30-A, and 40-A. Effective June 1, 1969, fire extinguishers classified for use on Class B fires have the following ratings: 1-B, 2-B, 5-B, 10-B, 20-B, 30-B, 40-B, 60-B, 80-B, 120-B, 160-B, 240-B, 320-B, 480-B, and 640-B. Ratings from 1-A to 20-A and 1-B to 20-B, inclusive, are based on indoor fire tests; ratings at or above 30-A and 30-B are based on outdoor fire tests.

For Class B fires, it should be recognized that the amount of fire that can be extinguished by a particular fire extinguisher is related to the degree of training and experience of the operator. For fire extinguishers classified for use on Class C fires, no number is used, since Class C fires are essentially either Class A or Class B fires involving energized electrical wiring and equipment. Other than when being discharged from an extinguisher, water-based agents are conductive, and agent pooling after discharge might present additional hazard concerns. The size of the different suitable fire extinguishers installed should be commensurate with the size and extent of the Class A or Class B components, or both, of the electrical hazard being protected.

For fire extinguishers classified for use on Class D fires, no number is used. The relative effectiveness of these fire extinguishers for use on specific combustible metal fires is detailed on the fire extinguisher nameplate.

Fire extinguishers that are effective on more than one class of fire have multiple letter and number-letter classifications and ratings.

The equivalency for Class B extinguishers rated under the rating classification system used prior to 1955 is given in Table G.2.

For extinguishers classified under the system used prior to 1955, the pre-1955 classifications of C, C-1, and C-2 are equivalent to the current C classification.

Carbon dioxide extinguishers with metal horns do not carry any C classification.

Table G.2 Class B Rating Equivalencies

Extinguisher Type and Capacity	Pre-1955 Rating	Equivalency
Foam (gal)		
2½	B-1	2-B
5	B-1	5-B
17	B	10-B
33	B	20-B
Carbon Dioxide (lb)		
Under 7	B-2	1-B
7	B-2	2-B
10 to 12	B-2	2-B
15 to 20	B-1	2-B
25 to 26	B-1	5-B
50	B-1	10-B
75	B-1	10-B
100	B	10-B
Dry Chemical (lb)		
4 to 6¼	B-2	2-B
7½	B-2	5-B
10 to 15	B-1	5-B
20	B-1	10-B
30	B-1	20-B
75 and up	B	40-B

For SI units, 1 gal = 3.785 L; 1 lb = 0.454 kg.

Annex H Conditions of Selection

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

H.1 Physical Conditions That Affect Selection. When a fire extinguisher is being selected, the following physical conditions should be considered:

(1) *Gross Weight.* In the selection of a fire extinguisher, the physical ability of the user should be taken into account. When the hazard exceeds the capability of a hand portable fire extinguisher, wheeled fire extinguishers or fixed systems *(see Section 1.1)* should be considered.

(2) *Corrosion.* In some fire extinguisher installations, there exists a possibility of the fire extinguisher being exposed to a corrosive atmosphere. Where this is the case, consideration should be given to providing the fire extinguishers so exposed with proper protection or to providing fire extinguishers that are suitable for use in these conditions.

(3) *Agent Reaction.* The possibility of adverse reactions, contamination, or other effects of an extinguishing agent on manufacturing processes, on equipment, or both should be considered in the selection of a fire extinguisher.

(4) *Wheeled Units.* Where wheeled fire extinguishers are used, consideration should be given to the mobility of the fire extinguisher within the area in which it will be used. For outdoor locations, the use of proper rubber-tire or wide-rimmed wheel designs should be considered according to terrain. For indoor locations, doorways and passages should be large enough to permit ready passage of the fire extinguisher.

(5) *Wind and Draft.* If the hazard is subject to winds or draft, the use of fire extinguishers and agents having sufficient range to overcome these conditions should be considered.

(6) *Availability of Personnel.* Consideration should be given to the number of persons available to operate the fire extinguishers, the degree of training provided, and the physical capability of the operators.

H.2 Health and Safety Conditions That Affect Selection. When a fire extinguisher is being selected, consideration should be given to the health and safety hazards involved in its maintenance and use, as described in the following items:

(1) For confined spaces, prominent caution labels on the fire extinguisher, warning signs at entry points, provision for remote application, extra-long-range fire extinguisher nozzles, special ventilation, provision of breathing apparatus and other personal protective equipment, and adequate training of personnel are among the measures that should be considered.

(2) Although halogenated agent–type fire extinguishers contain agents whose vapor has a low toxicity, their decomposition products can be hazardous. When using these fire extinguishers in unventilated places, such as small rooms, closets, motor vehicles, or other confined spaces, operators and others should avoid breathing the gases produced by thermal decomposition of the agent.

(3) Carbon dioxide fire extinguishers contain an extinguishing agent that will not support life when used in sufficient concentration to extinguish a fire. The use of this type of fire extinguisher in an unventilated space can dilute the oxygen supply. Prolonged occupancy of such spaces can result in loss of consciousness due to oxygen deficiency.

(4) Fire extinguishers not rated for Class C hazards (e.g., water, antifreeze, loaded stream, AFFF, FFFP, wetting agent, and foam) present a shock hazard if used on fires involving energized electrical equipment.

(5) When used in a small unventilated area, dry chemical fire extinguishers can reduce visibility for a period of up to several minutes. Dry chemical discharged in an area can also clog filters in air-cleaning systems.

(6) A dry chemical fire extinguisher containing ammonium compounds should not be used on oxidizers that contain chlorine. The reaction between the oxidizer and the ammonium salts can produce the explosive compound nitrogen trichloride (NCl_3).

(7) Halogenated extinguishers should not be used on fires involving oxidizers, since they can react with the oxidizer.

(8) Most fires produce toxic decomposition products of combustion, and some materials, upon burning, can produce highly toxic gases. Fires can also consume available oxygen or produce dangerously high exposure to convected or radiated heat. All of these can affect the degree to which a fire can be safely approached with fire extinguishers.

Table H.2 summarizes the characteristics of fire extinguishers and can be used as an aid in selecting fire extinguishers in accordance with Chapter 5. The ratings given are those that were in effect at the time this standard was prepared. Current listings should be consulted for up-to-date ratings.

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Table H.2 Characteristics of Extinguishers

Extinguishing Agent	Method of Operation	Capacity	Horizontal Range of Stream	Approximate Time of Discharge	Protection Required Below 40°F (4°C)	UL or ULC Classifications[a]
Water	Stored-pressure	6 L	30 to 40 ft	40 sec	Yes	1-A
	Stored-pressure or pump	2½ gal	30 to 40 ft	1 min	Yes	2-A
	Pump	4 gal	30 to 40 ft	2 min	Yes	3-A
	Pump	5 gal	30 to 40 ft	2 to 3 min	Yes	4-A
Water (wetting agent)	Stored-pressure	1½ gal	20 ft	30 sec	Yes	2-A
	Stored-pressure	25 gal (wheeled)	35 ft	1½ min	Yes	10-A
	Stored-pressure	45 gal (wheeled)	35 ft	2 min	Yes	30-A
	Stored-pressure	60 gal (wheeled)	35 ft	2½ min	Yes	40-A
Loaded stream	Stored-pressure	2½ gal	30 to 40 ft	1 min	No	2-A
	Stored-pressure	33 gal (wheeled)	50 ft	3 min	No	20-A
AFFF, FFFP	Stored-pressure	2½ gal	20 to 25 ft	50 sec	Yes	3-A:20 to 40-B
	Stored-pressure	6 L	20 to 25 ft	50 sec	Yes	2-A:10-B
	Nitrogen cylinder	33 gal	30 ft	1 min	Yes	20-A:160-B
Carbon dioxide[b]	Self-expelling	2½ to 5 lb	3 to 8 ft	8 to 30 sec	No	1 to 5-B:C
	Self-expelling	10 to 15 lb	3 to 8 ft	8 to 30 sec	No	2 to 10-B:C
	Self-expelling	20 lb	3 to 8 ft	10 to 30 sec	No	10-B:C
	Self-expelling	50 to 100 lb (wheeled)	3 to 10 ft	10 to 30 sec	No	10 to 20-B:C
Regular dry chemical (sodium bicarbonate)	Stored-pressure	1 to 2½ lb	5 to 8 ft	8 to 12 sec	No	2 to 10-B:C
	Cartridge or stored-pressure	2¾ to 5 lb	5 to 20 ft	8 to 25 sec	No	5 to 20-B:C
	Cartridge or stored-pressure	6 to 30 lb	5 to 20 ft	10 to 25 sec	No	10 to 160-B:C
	Stored-pressure	50 lb (wheeled)	20 ft	35 sec	No	160-B:C
	Nitrogen cylinder or stored-pressure	75 to 350 lb (wheeled)	15 to 45 ft	20 to 105 sec	No	40 to 320-B:C
Purple K dry chemical (potassium bicarbonate)	Cartridge or stored-pressure	2 to 5 lb	5 to 12 ft	8 to 10 sec	No	5 to 30-B:C
	Cartridge or stored-pressure	5½ to 10 lb	5 to 20 ft	8 to 20 sec	No	10 to 80-B:C
	Cartridge or stored-pressure	16 to 30 lb	10 to 20 ft	8 to 25 sec	No	40 to 120-B:C
	Cartridge or stored-pressure	48 to 50 lb (wheeled)	20 ft	30 to 35 sec	No	120 to 160-B:C
	Nitrogen cylinder or stored-pressure	125 to 315 lb (wheeled)	15 to 45 ft	30 to 80 sec	No	80 to 640-B:C
Super K dry chemical (potassium chloride)	Cartridge or stored-pressure	2 to 5 lb	5 to 8 ft	8 to 10 sec	No	5 to 10-B:C
	Cartridge or stored-pressure	5 to 9 lb	8 to 12 ft	10 to 15 sec	No	20 to 40-B:C
	Cartridge or stored-pressure	9½ to 20 lb	10 to 15 ft	15 to 20 sec	No	40 to 60-B:C
	Cartridge or stored-pressure	19½ to 30 lb	5 to 20 ft	10 to 25 sec	No	60 to 80-B:C
	Cartridge or stored-pressure	125 to 200 lb (wheeled)	15 to 45 ft	30 to 40 sec	No	160-B:C

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Table H.2 ***Continued***

Extinguishing Agent	Method of Operation	Capacity	Horizontal Range of Stream	Approximate Time of Discharge	Protection Required Below 40°F (4°C)	UL or ULC Classifications[a]
Multipurpose/ABC dry chemical (ammonium phosphate)	Stored-pressure	1 to 5 lb	5 to 12 ft	8 to 10 sec	No	1 to 3-A[c] and 2 to 10-B:C
	Stored-pressure or cartridge	2½ to 9 lb	5 to 12 ft	8 to 15 sec	No	1 to 4-A and 10 to 40-B:C
	Stored-pressure or cartridge	9 to 17 lb	5 to 20 ft	10 to 25 sec	No	2 to 20-A and 10 to 80-B:C
	Stored-pressure or cartridge	17 to 30 lb	5 to 20 ft	10 to 25 sec	No	3 to 20-A and 30 to 120-B:C
	Stored-pressure or cartridge	45 to 50 lb (wheeled)	20 ft	25 to 35 sec	No	20 to 30-A and 80 to 160-B:C
	Nitrogen cylinder or stored-pressure	110 to 315 lb (wheeled)	15 to 45 ft	30 to 60 sec	No	20 to 40-A and 60 to 320-B:C
Dry chemical (foam-compatible)	Cartridge or stored-pressure	4¾ to 9 lb	5 to 20 ft	8 to 10 sec	No	10 to 20-B:C
	Cartridge or stored-pressure	9 to 27 lb	5 to 20 ft	10 to 25 sec	No	20 to 30-B:C
	Cartridge or stored-pressure	18 to 30 lb	5 to 20 ft	10 to 25 sec	No	40 to 60-B:C
	Nitrogen cylinder or stored-pressure	150 to 350 lb (wheeled)	15 to 45 ft	20 to 150 sec	No	80 to 240-B:C
Dry chemical (potassium bicarbonate urea based)	Stored-pressure	5 to 11 lb	11 to 22 ft	18 sec	No	40 to 80-B:C
	Stored-pressure	9 to 23 lb	15 to 30 ft	17 to 33 sec	No	60 to 160-B:C
		175 lb (wheeled)	70 ft	62 sec	No	480-B:C
Wet chemical	Stored-pressure	3 L	8 to 12 ft	30 sec	No	K
	Stored-pressure	6 L	8 to 12 ft	35 to 45 sec	No	K
	Stored-pressure	2½ gal	8 to 12 ft	75 to 85 sec	No	K
Halon 1211 (bromochlorodifluoromethane)	Stored-pressure	0.9 to 2 lb	6 to 10 ft	8 to 10 sec	No	1 to 2-B:C
	Stored-pressure	2 to 3 lb	6 to 10 ft	8 to 10 sec	No	5-B:C
	Stored-pressure	5½ to 9 lb	9 to 15 ft	8 to 15 sec	No	1-A:10-B:C
	Stored-pressure	13 to 22 lb	14 to 16 ft	10 to 18 sec	No	2 to 4-A and 20 to 80-B:C
	Stored-pressure	50 lb	35 ft	30 sec	No	10-A:120-B:C
	Stored-pressure	150 lb (wheeled)	20 to 35 ft	30 to 44 sec	No	30-A:160 to 240-B:C
Halon 1211/1301 (bromochlorodifluoromethane bromotrifluoromethane) mixtures	Stored-pressure or self-expelling	0.9 to 5 lb	3 to 12 ft	8 to 10 sec	No	1 to 10-B:C
	Stored-pressure	9 to 20 lb	10 to 18 ft	10 to 22 sec	No	1-A:10-B:C to 4-A:80-B:C
Halocarbon type	Stored-pressure	1.4 to 150 lb	6 to 35 ft	9 to 38 sec	No	1-B:C to 10-A:80-B:C

For SI units: 1 gal = 3.79 L; 1 lb = 2.2 kg; 1 ft = 0.305 m.

Note: Halon should be used only where its unique properties are deemed necessary.

[a] UL and ULC ratings as of July 24, 1987. Readers concerned with subsequent ratings should review the pertinent lists and supplements issued by these laboratories: Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062, or Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, ON, M1R 3B4, Canada.

[b] Carbon dioxide extinguishers with metal horns do not carry a C classification.

[c] Some small extinguishers containing ammonium phosphate–based dry chemical do not carry an A classification.

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Annex I Maintenance Procedures

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

I.1 Maintenance Checklists. For convenience, the following checklists are organized into two parts. The first, Table I.1(a), is arranged by mechanical parts (components and containers) common to most fire extinguishers. The second, Table I.1(b), is arranged by extinguishing material and expelling means and involves a description of the problems peculiar to each agent.

Table I.1(a) Mechanical Parts Maintenance Checklist

Cylinder/Shell	**Corrective Action**
1. Hydrostatic test date or date of manufacture	1. Retest, if needed
2. Corrosion	2. Conduct hydrostatic test and refinish, or condemn
3. Mechanical damage (denting or abrasion)	3. Conduct hydrostatic test and refinish, or condemn
4. Paint condition	4. Refinish
5. Presence of repairs (welding, soldering, brazing, etc.)	5. Condemn
6. Damaged threads (corroded, crossthreaded, or worn)	6. Condemn
7. Broken hanger attachment, carrying handle lug	7. Condemn
8. Sealing surface damage (nicks or corrosion)	8. Condemn
Nameplate	**Corrective Action**
1. Illegible wording	1. Clean or replace (Note: Only labels without a listing mark can be replaced.)
2. Corrosion or loose plate	2. Inspect shell under plate (see Cylinder/Shell check points) and reattach plate
Nozzle or Horn	**Corrective Action**
1. Deformed, damaged, or cracked	1. Replace
2. Blocked openings	2. Clean
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace
4. Aged (brittle)	4. Replace
Hose Assembly	**Corrective Action**
1. Damaged (cut, cracked, or worn)	1. Replace
2. Damaged couplings or swivel joint (cracked or corroded)	2. Replace
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace
4. Inner tube cut at couplings	4. Replace or consult manufacturer
5. Electrically nonconductive between couplings (CO_2 hose only)	5. Replace
6. Hose obstruction	6. Remove obstruction or replace
7. Hydrostatic test date	7. Retest if needed
Pull/Ring Pin	**Corrective Action**
1. Damaged (bent, corroded, or binding)	1. Replace
2. Missing	2. Replace
Gauge or Pressure-Indicating Device	**Corrective Action**
1. Immovable, jammed, or missing pointer (pressure test)	1. Depressurize and replace gauge
2. Missing, deformed, or broken crystal	2. Depressurize and replace gauge
3. Illegible or faded dial	3. Depressurize and replace gauge
4. Corrosion	4. Depressurize and check calibration, clean and refinish, or replace gauge
5. Dented case or crystal retainer	5. Depressurize and check calibration, or replace gauge
6. Immovable or corroded pressure-indicating stem (nongauge type)	6. Depressurize and discard shell
7. Verify gauge compatibility	7. Depressurize and replace
Shell or Cylinder Valve	**Corrective Action**
1. Corroded, damaged, or jammed lever, handle, spring, stem, or fastener joint	1. Depressurize, check freedom of movement, and repair or replace
2. Damaged outlet threads (corroded, crossthreaded, or worn)	2. Depressurize and replace

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Table I.1(a) *Continued*

Nozzle Shutoff Valve	**Corrective Action**
1. Corroded, damaged, jammed, or binding lever, spring, stem, or fastener joint	1. Repair and lubricate, or replace
2. Plugged, deformed, or corroded nozzle tip or discharge passage	2. Clean or replace
Puncture Mechanism	**Corrective Action**
1. Damaged, jammed, or binding puncture lever, stem, or fastener joint	1. Replace
2. Dull or damaged cutting or puncture pin	2. Replace
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace
Expellant/Gas Cartridge	**Corrective Action**
1. Corrosion	1. Replace with correct expellant gas cartridge
2. Damaged seal disc (injured, cut, or corroded)	2. Replace with correct expellant gas cartridge
3. Damaged threads (corroded, crossthreaded, or worn)	3. Replace with correct expellant gas cartridge
4. Illegible weight markings	4. Replace with correct expellant gas cartridge
5. Improper gas cartridge	5. Replace with correct expellant gas cartridge
6. Improper cartridge seal	6. Replace with correct expellant gas cartridge
Gas Cylinders	**Corrective Action**
1. Hydrostatic test date or date of manufacture	1. Retest if needed
2. Corrosion	2. Conduct hydrostatic test and refinish, or discard
3. Paint condition	3. Refinish
4. Presence of repairs (welding, soldering, brazing, etc.)	4. Condemn
5. Damaged threads (corroded, crossthreaded, or worn)	5. Condemn
Fill Cap	**Corrective Action**
1. Corroded, cracked, or broken	1. Replace
2. Damaged threads (corroded, crossthreaded, or worn)	2. Replace
3. Sealing surface damage (nicked, deformed, or corroded)	3. Clean, repair, and leak test, or replace
4. Obstructed vent hole or slot	4. Clean
Nonrechargeable Shell/Cylinder	**Corrective Action**
1. Corrosion	1. Depressurize and discard
2. Damaged seal disc (injured, cut, or corroded)	2. Depressurize and discard
3. Damaged threads (corroded, crossthreaded, or worn)	3. Depressurize and discard
4. Illegible weight or date markings	4. Depressurize and discard
Carriage and Wheels	**Corrective Action**
1. Corroded, bent, or broken carriage	1. Repair or replace
2. Damaged wheel (buckled or broken spoke, bent rim or axle, loose tire, low pressure, jammed bearing)	2. Clean, repair, and lubricate, or replace
Carrying Handle	**Corrective Action**
1. Broken handle lug	1. Condemn cylinder or consult manufacturer regarding repair
2. Broken handle	2. Replace
3. Corroded, jammed, or worn fastener	3. Clean or replace
Tamper Seals or Indicators	**Corrective Action**
1. Broken or missing	1. Check Table I.1(b) for specific action
2. Fill cap indicator corroded or inoperative	2. Repair, clean, or replace
3. Fill cap indicator operated	3. Depressurize unit, check content, refill
Hand Pump	**Corrective Action**
1. Corroded, jammed, or damaged pump	1. Repair and lubricate, or replace
2. Improper adjustment of packing nut	2. Adjust

(continues)

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Table I.1(a) *Continued*

Pressurizing Valve	Corrective Action
1. Leaking seals	1. Depressurize and replace valve or core
Gasket and "O" Ring Seals	**Corrective Action**
1. Damaged (cut, cracked, or worn)	1. Replace and lubricate
2. Missing	2. Replace and lubricate
3. Aged or weathered (compression set, brittle, cracked)	3. Replace and lubricate
Brackets and Hangers	**Corrective Action**
1. Corroded, worn, or bent	1. Repair and refinish, or replace
2. Loose or binding fit	2. Adjust fit or replace
3. Worn, loose, corroded, or missing screw or bolt	3. Tighten or replace
4. Worn bumper, webbing, or grommet	4. Replace
5. Improper type	5. Replace
Gas Tube and Siphon or Pickup Tube	**Corrective Action**
1. Corroded, dented, cracked, or broken	1. Replace
2. Blocked tube or openings in tube	2. Clean or replace
Safety Relief Device	**Corrective Action**
1. Corroded or damaged	1. Depressurize and replace
2. Broken, operated, or plugged	2. Depressurize and replace
Pressure Regulators	**Corrective Action**
1. External condition: damaged or corroded	1. If damaged, replace regulator; if corroded, clean regulator or replace
2. Pressure relief (corroded, plugged, dented, leaking, broken, or missing)	2. Disconnect regulator from pressure source, replace pressure relief, or replace regulator
3. Protective bonnet relief hole (tape missing or seal wire broken or missing)	3. Replace regulator
4. Adjusting screw (lock pin missing)	4. Replace regulator

Table I.1(b) Agent and Expelling Means Maintenance Checklist

AFFF and FFP	Corrective Action
1. Recharging date due	1. Empty, clean, and recharge
2. Improper fill levels	2. Empty, clean, and recharge
3. Agent condition (check for sediment)	3. Empty, clean, and recharge
4. Improper fill level (by weight or observation)	4. Empty and recharge with new solution
5. Agent condition (presence of precipitate or other foreign matter)	5. Empty and recharge with new solution
6. Improper gauge pressure	6. Repressurize and leak test
7. Broken or missing tamper indicator	7. Leak test, replace indicator
Self-Expelling	
Carbon Dioxide	**Corrective Action**
1. Improper weight	1. Recharge to proper weight
2. Broken or missing tamper indicator	2. Leak test and weigh, also recharge or replace seal
Halon 1301 Bromotrifluoromethane	**Corrective Action**
1. Punctured cylinder seal disc	1. Replace shell
2. Improper weight	2. Replace shell or return to manufacturer for refilling
3. Broken or missing tamper seal	3. Examine cylinder seal disc, replace seal
Combination Halon 1211/1301	**Corrective Action**
1. Improper weight	1. Return to manufacturer *(See 7.2.3.3.)*
2. Broken or missing tamper seal	2. Return to manufacturer *(See 7.2.3.3.)*

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Table I.1(b) *Continued*

Manually Operated	
Mechanical Pump Water and Loaded Stream	**Corrective Action**
1. Improper fill level	1. Refill to proper level
2. Defective pump	2. Clean, repair, and lubricate, or replace
Dry Powder Pail	**Corrective Action**
1. Improper fill level	1. Refill
2. Agent condition (contamination or caking)	2. Discard and replace
3. Missing scoop	3. Replace
Gas Cartridge or Cylinder	
Dry Chemical and Dry Powder Types	**Corrective Action**
1. Improper weight or charge level	1. Refill to correct weight or charge level
2. Agent condition (contamination, caking, or wrong agent)	2. Empty and recharge with new agent
3. Cartridge	3.
(a) Punctured seal disc	(a) Replace cartridge
(b) Improper weight	(b) Replace cartridge
(c) Broken or missing tamper indicator	(c) Examine seal disc, replace
(d) Improper cartridge seal	(d) Replace cartridge seal
4. Gas cylinder with gauge	4.
(a) Low pressure	(a) Replace or recharge cylinder
(b) Broken or missing tamper seal	(b) Leak test, replace
5. Gas cylinder without gauge	5.
(a) Low pressure (attach gauge and measure pressure)	(a) Leak test (if low, replace or recharge cylinder)
(b) Broken or missing tamper seal	(b) Measure pressure, leak test, replace seal
Stored-Pressure	
Combination Halon 1211/1301	**Corrective Action**
1. Refillable	1.
(a) Improper extinguisher agent	(a) Return to manufacturer *(See 7.2.3.3.)*
(b) Improper gauge pressure	(b) Return to manufacturer *(See 7.2.3.3.)*
(c) Broken or missing tamper seal	(c) Examine extinguisher, leak test, replace tamper seal
2. Nonrechargeable extinguisher with pressure indicator	2.
(a) Low pressure	(a) Return to manufacturer *(See 7.2.3.3.)*
(b) Broken or missing tamper seal	(b) Return to manufacturer *(See 7.2.3.3.)*
Dry Chemical and Dry Powder Types	**Corrective Action**
1. Rechargeable	1.
(a) Improper extinguisher weight	(a) Leak test and refill to correct weight
(b) Improper gauge pressure	(b) Repressurize and leak test
(c) Broken or missing tamper seal	(c) Leak test, check weight, and replace seal
2. Disposable shell with pressure indicator	2.
(a) Punctured seal disc	(a) Depressurize and discard
(b) Low pressure	(b) Depressurize and discard
(c) Broken or missing tamper indicator	(c) Depressurize and discard
3. Disposable shell without pressure indicator	3.
(a) Punctured seal disc	(a) Depressurize and discard
(b) Low weight	(b) Depressurize and discard
(c) Broken or missing tamper seal	(c) Depressurize and discard
4. Nonrechargeable extinguisher with pressure indicator	4.
(a) Low pressure	(a) Depressurize and discard
(b) Broken or missing tamper indicator	(b) Depressurize and discard

(continues)

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Table I.1(b) *Continued*

Wet Chemical Type	Corrective Action
1. Improper fill level (by weight or observation)	1. Empty and recharge with new agent to correct weight fill line
2. Improper gauge pressure	2. Repressurize and leak test or consult manufacturer
3. Broken or missing tamper seal	3. Verify fill level, recharge if required, replace tamper seal
Halogenated-Type Agents	**Corrective Action**
1. Broken or missing tamper seal	1. Verify level and pressure, recharge if required, replace tamper seal
2. Improper gauge pressure	2. Weigh, repressurize, and leak test or consult manufacturer
3. Improper weight	3. Leak test and recharge to correct weight
Water and Loaded Stream	**Corrective Action**
1. Improper fill level (by weight or observation)	1. Recharge to correct level in accordance with the manufacturer's manual
2. Agent condition if antifreeze or loaded stream	2. Empty and recharge with new agent
3. Improper gauge pressure	3. Repressurize and leak test or consult manufacturer
4. Broken or missing tamper seal	4. Leak test, replace seal

I.1.1 Many of the recommendations in Table I.1(a) and Table I.1(b) are not applicable to disposable fire extinguisher models. Any discrepancy on the maintenance of disposable models will often dictate the need for extinguisher replacement. Service personnel should refer to the nameplate instructions and the owner's manual for guidance.

I.1.2 Disposable Halon agent fire extinguisher models requiring replacement are not to be depressurized but returned to the manufacturer or service agency for proper disposal and reclaiming of the extinguishing agent.

All corrective actions must be performed in accordance with the manufacturer's service manual.

Annex J Typical Specification of Equipment Capable of Producing Dry Air

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

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J.1 Introduction. Section J.2 is an example of a specification of equipment capable of producing dry air.

J.2 Example. The compressor/dryer module shall be a fully enclosed, factory-assembled, and factory-tested package of a vertical design (compressor above motor). It shall incorporate the compressor driver, purification system, controls, interconnecting piping, and wiring. The scope of supply shall include the following:

(1) *Compressor.* The compressor block shall be multistage, air cooled, oil lubricated, and rated for continuous duty at 5000 psi (34,475 kPa) with a charging rate of [________ cfm]. The crankcase shall be fully enclosed with oversized ball bearings on each end. The connecting rods shall utilize needle bearings on both ends. Pistons shall be aluminum or cast iron and shall incorporate piston rings on all stages. Cylinders shall be of cast iron. Relief valves and individually mounted intercoolers shall be utilized after each stage of compression. The aftercooler shall be designed to deliver final air at a temperature not to exceed 20°F (11°C) above ambient. The compressor flywheel shall incorporate a high-velocity cooling fan for maximum heat dissipation. An automatic condensate drain system shall be supplied as standard equipment on all systems.

(2) *Dryer System.* The system shall be of a multichamber arrangement, each constructed of aluminum alloy with a tensile strength of 83,000 psi (572,285 kPa) and designed for 5000 psi (34,475 kPa) working pressure with a 4 to 1 safety factor. The first chamber shall be a mechanical separator to eliminate oil and water. Subsequent chambers shall utilize replacement cartridges to further remove moisture and oil vapor. The dryer system shall process [______ cf] before cartridge replacement. The air delivered shall have a –60°F (–51.1°C) dew point or lower.

(3) *Controls/Instrumentation.* The compressor module shall incorporate a gauge panel to include the following: interstage and final discharge pressure gauges, lube oil pressure gauge (where applicable), hour meter, and power-on light. All pressure gauges shall be liquid filled. The control system shall consist of all devices to monitor the operation of the compressor, including motor starter with overload detectors and switches to shut the compressor down in the event that high temperature or low oil pressure (on pressure-lubricated compressors) occurs. An air pressure switch shall be supplied to automatically start and stop the compressor to maintain adequate system pressure. [The unit shall come complete with a cartridge monitoring system that combines both moisture monitoring and timed shutdown. The moisture monitor checks air quality continuously and is calibrated to indicate when a dew point of –60°F (–51.1°C) has been reached. When moisture is detected, a yellow light comes on and the digital timer comes into operation. At the conclusion of a 1-hour to 2-hour timing period, shutdown occurs and a red light comes on.]

Annex K Informational References

K.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

K.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2010 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2008 edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2009 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2010 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes*, 2010 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, 2010 edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2010 edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2007 edition.

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2007 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2009 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2009 edition.

NFPA 18, *Standard on Wetting Agents*, 2006 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2010 edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2008 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2010 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2008 edition.

Fire Protection Guide to Hazardous Materials, 13th edition, 2001.

Fire Protection Handbook, 20th edition, 2008.

K.1.2 Other Publications.

K.1.2.1 CGA Publications. Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923.

CGA C-1, *Methods of Hydrostatic Testing of Compressed Gas Cylinders*, 2006.

K.1.2.2 NPCA Publications. National Paint and Coatings Association, 1500 Rhode Island Avenue, NW, Washington, DC 20005.

Hazardous Materials Identification System (HMIS), Implementational Manual, 1981.

K.1.2.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 299, *Standard for Dry Chemical Fire Extinguishers*, 1984.

ANSI/UL 711, *Standard for Rating and Fire Testing of Fire Extinguishers*, 1984 and 2004, Revised 2007.

• UL 711, 1984 ed.

ANSI/UL 1093, *Standard for Halogenated Agent Fire Extinguishers*, 1995, Revised 2008.

ANSI/UL 2129, *Standard for Halocarbon Clean Agent Fire Extinguishers*, 2005, Revised 2007.

K.1.2.4 U.S. Government Publications. U.S. Government Printing Office, Washington, DC 20402.

Title 49, Code of Federal Regulations.

K.2 Informational References. (Reserved)

K.3 References for Extracts in Informational Sections. (Reserved)

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 5.5.5 and 6.6.1
F.I. No.: 10-02-2

Background: NFPA 10, subsection 5.5.5 requires that fire extinguishers be provided for the protection of cooking appliances that use combustible cooking media (vegetable or animal oils and fats) be listed and labeled for Class K fires. Subsection 6.6.1 requires class K fire extinguishers be provided for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats). Based on these two requirements, there is confusion with regard to requiring class K extinguishers for stove top cooking.

Questions No. 1: Do subsections 5.5.5 and 6.6.1 require class K extinguishers to be installed for commercial fryers employing combustible cooking media (vegetable or animal oils and fats)?

Answer: Yes

Questions No. 2: Do subsections 5.5.5 and 6.6.1 require class K extinguishers to be installed for a griddle?

Answer: Yes

Questions No. 3: Do subsections 5.5.5 and 6.6.1 require class K extinguishers to be installed for a stove top frying pan?

Answer: Yes

FAIR USE

Issue Edition: 2002
Reference: 4.2.3 and 5.7.1
Issue Date: July 7, 2005
Effective Date: July 27, 2005

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 5.5.5.3
F.I. No.: 10-98-3

Background: 5.5.5.3 A placard shall be conspicuously placed near the extinguisher that states that the fire protection system shall be activated prior to using the fire extinguisher.

Question: Is it the intent of the Committee that the instructions on this placard apply to all Class K fires including those other than the deep fryer fires?

Answer: Yes.

Issue Edition: 1998
Reference: 2-3.2.1
Issue Date: January 22, 2002
Effective Date: February 11, 2002

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

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Reference: 6.2.1.1, 6.2.1.2, 6.2.1.5
F.I. 84-2

Background: During regular maintenance of fire extinguishers in an apartment building, it was found that extinguishers were provided on the main or ground level floor and not on the second floor or basement level. The apartment proprietors explained that the rationale for not providing extinguishers on the second or basement level was that the extinguishers on the main level are within the 75-ft maximum travel distance, if the stairway is included in the calculations.

Question: Does NFPA 10 prohibit the inclusion of a flight(s) of stairs in the calculation of travel distance?

Answer: Yes. Travel distance is intended to reflect the time it takes to respond with an extinguisher to a fire emergency. A staircase slows down response time. Furthermore, there could well be interference to obtaining and transporting the extinguisher from tenants vacating the premises. Paragraph 6.1.3.1 states, “Extinguishers shall be conspicuously located where they will be readily accessible and immediately available in the event of fire,” and 6.1.3.3.1 states, “Fire extinguishers shall not be obstructed or obscured from view.” Extinguishers located on another floor do not meet the intent of these paragraphs.

Issue Edition: 1984
Reference: 3-2.1, 3-2.3
Date: October 1984

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

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Reference: 7.1.2.1, 7.1.2.2, 7.3.1.1.1, 7.3.2.1.2
F.I. No.: 10-98-1

Background: Some people claim that a maintenance procedure that does not require internal maintenance is essentially the same as a monthly inspection procedure, so only minimal knowledge is required and no special training.

Some people claim persons performing the external examination required by 7.3.2.1.2 need special training, the manufacturer's maintenance manual, repair parts, and appropriate servicing equipment.

Question: Subparagraph 7.3.1.1.1 requires extinguishers to undergo maintenance annually. Subparagraph 7.3.2.1.2 requires certain extinguishers to be examined externally only. Are individuals conducting this external maintenance required to be trained in accordance with 7.1.2.1 and 7.1.2.2?

Answer: Yes.

Issue Edition: 1998
Reference: 4-1.4, 4-4.1, and 4-4.2
Issue Date: December 15, 1998
Effective Date: January 4, 1999

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 7.2.4.4
F.I. No.: 10-02-1

Background: Inspection authorities (fire officials, JCAHO, etc.) have and can interpret NFPA 10, 7.2.4.4 fairly stringently due to its current wording. One inspection authority has interpreted this section to require our facilities to keep monthly tags on every fire extinguisher in perpetuity because NFPA 10, 7.2.4.4 currently requires "Records for manual inspections shall be kept on a tag or label attached to the fire extinguisher, or an inspection checklist maintained on file, or by an electronic method."

Questions No. 1: Where records are kept on a tag or label attached to a fire extinguisher, do the records need to be kept permanently?

Answer: No

Questions No. 2: Where records are kept on a tag or label attached to a fire extinguisher, do the records need to be kept permanently attached to the extinguisher?

Answer: No

Questions No. 3: Where records are kept on an inspection checklist, do the records need to be kept permanently?

Answer: No

Questions No. 4: Where records are kept by an electronic method, do the records need to be kept permanently?

Answer: No

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Issue Edition: 2002
Reference: 6.2.4.3
Issue Date: February 23, 2004
Effective Date: March 13, 2004

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 7.3.1.1.1
F.I. No.: 10-98-2

Background: Some people interpret 7.3.1.1.1 to mean that it is acceptable either to do maintenance at yearly intervals or to do maintenance when an inspection specifically indicates the need. Either program will satisfy NFPA 10 requirements.

Question: Is it the intent of 7.3.1.1.1 that all fire extinguishers should be subjected to maintenance at a maximum interval of not more than 1 year?

Answer: Yes.

Issue Edition: 1998
Reference: 4-4.1
Issue Date: December 15, 1998
Effective Date: January 4, 1999

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 7.3.2
F.I. 84-5

Background: Subsection 7.3.2 states: “Maintenance procedures shall include a thorough examination of the basic elements of fire extinguishers and components of the electronic monitoring system as determined below and following the procedures detailed in the manufacturer service manual:

(1) Mechanical parts of all fire extinguishers

(2) Extinguishing agent of cartridge- or cylinder-operated dry chemical, stored-pressure, loaded stream, and pump tank fire extinguishers

(3) Expelling means of all fire extinguishers

(4) Physical appearance

(5) Components of electronically monitored system"

Referring now to Annex I, Table I.1(a), “Mechanical Parts Maintenance Checklist,” calls for a check of “Gas Tube and Siphon or Pickup Tube” and Table I.1(b), “Agent and Expelling Means Maintenance Checklist,” calls for a check of “Agent Condition (contamination, caking, or wrong agent).”

Question: To do the above two check points, is it the intent to require emptying, annually, a cartridge-operated dry chemical extinguisher?

Answer: No.

Issue Edition: 1984
Reference: 4-4.2
Date: March 1986

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

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Reference: 7.4.1.4
F.I. 84-3

Background: A system has been submitted to a laboratory for listing that is intended for the rebuilding of 2 ½-gallon, stainless steel, stored-pressure, water fire extinguishers that were manufactured in 1964 or later. The extinguishers would be thoroughly inspected and tested, fitted with a new hose and solid AFFF cartridge nozzle, and relabeled. No modifications would be made to the internal parts of the extinguisher, and the extinguisher charge remains exactly as originally designed. The entire operation would be subjected to follow-up inspections by the testing laboratory and accomplished only at locations authorized by the laboratory. The rating of the extinguisher is upgraded from 2-A to 3-A:40-B, thus providing the owner of the extinguisher with a significant increase in fire extinguishing capability. A laboratory has accepted the system for test but is unlikely to list it until the question of possible conflict with 7.4.1.4 is answered.

Question 1: Is it the intent of 7.4.1.4 to prohibit field alteration or conversion of listed portable extinguishers from one type to another?

Answer: Yes.

Issue Edition: 1984
Reference: 4-5.3.8
Date: January 1985
Reissued to correct error: January 1986

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Formal Interpretation

NFPA 10

Portable Fire Extinguishers

2010 Edition

Reference: 8.3.1
F.I. 84-1

Background: A 12-year testing interval has been used when portable CO_2 fire extinguishers have not been discharged. Consequently, this procedure has saved a considerable amount of time and money.

Question: Is it the intent of 8.3.1 that all portable CO_2 fire extinguishers be hydrostatically tested every 5 years, regardless of whether or not they have been discharged?

Answer: Yes.

Issue Edition: 1984
Reference: 5-2
Date: June 1984

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Sequence of Events Leading to Issuance of an NFPA Committee Document

Step 1: Call for Proposals

- Proposed new Document or new edition of an existing Document is entered into one of two yearly revision cycles, and a Call for Proposals is published.

Step 2: Report on Proposals (ROP)

- Committee meets to act on Proposals, to develop its own Proposals, and to prepare its Report.
- Committee votes by written ballot on Proposals. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Proposals (ROP) is published for public review and comment.

Step 3: Report on Comments (ROC)

- Committee meets to act on Public Comments to develop its own Comments, and to prepare its report.
- Committee votes by written ballot on Comments. If two-thirds approve, Report goes forward. Lacking two-thirds approval, Report returns to Committee.
- Report on Comments (ROC) is published for public review.

Step 4: Technical Report Session

- "*Notices of intent to make a motion*" are filed, are reviewed, and valid motions are certified for presentation at the Technical Report Session. ("Consent Documents" that have no certified motions bypass the Technical Report Session and proceed to the Standards Council for issuance.)
- NFPA membership meets each June at the Annual Meeting Technical Report Session and acts on Technical Committee Reports (ROP and ROC) for Documents with "certified amending motions."
- Committee(s) vote on any amendments to Report approved at NFPA Annual Membership Meeting.

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Step 5: Standards Council Issuance

- Notification of intent to file an appeal to the Standards Council on Association action must be filed within 20 days of the NFPA Annual Membership Meeting.
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Revise definition of effective ground-fault current path to read:

3.3.78 Effective Ground-Fault Current Path. An intentionally constructed, permanent, low impedance electrically conductive path designed and intended to carry ~~underground~~ electric fault current ~~conditions~~ from the point of a ground fault on a wiring system to the electrical supply source.

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